User's Guide

to accompany the

HIV Prevention Funding Allocation Model (HPFAM)

Prepared by:
Katherine A. Hicks
Kathleen Wirth

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1. Introduction

In its 2001 report, *No Time to Lose: Getting More from HIV Prevention*, the Institute of Medicine (IOM) recommended a new goal for distributing HIV prevention resources: to prevent as many new HIV infections as possible (Ruiz et al., 2001). However, health departments and other Centers for Disease Control and Prevention (CDC) grantees face many competing demands when deciding how to allocate HIV prevention resources, including the need to be responsive to the prevention priorities established by community planning groups (CPGs), the need to allocate resources efficiently and equitably, and the need to satisfy political constraints that may affect how and to whom prevention dollars may be allocated.

The objective of the HIV Prevention Funding Allocation Model ("HPFAM") is to provide grantees with a tool they can use to allocate available HIV prevention funds across priority populations in a way that maximizes the number of potential infections averted and represents the priorities of multiple stakeholders, including CPGs. In practice, the HPFAM allocates available funds to maximize the weighted number of potential infections averted. The number of potential infections averted is a measure of the number of infections that would be expected in the priority populations in the absence of preventive efforts. The weights represent CPG priorities for prevention. In this guide, we sometimes refer to the weighted number of potential infections averted as the "potential impact" of preventive efforts.

The HPFAM uses Microsoft Excel, spreadsheet software that comes with the Microsoft Office Professional Package. Users enter information about the geographic regions for which risk populations are prioritized and the priority populations themselves. They also select what type of equity constraints to consider in their allocation. The program uses the stored information to generate a resource allocation report that shows the amount of money to allocate to priority populations to maximize adherence to CPG priorities and the potential number of infections averted, given the input provided for populations, regions, and equity constraints.

1.1 Where the HPFAM Fits into the Allocation Process

Every grantee has a different method for allocating prevention funds. Because of these differences, the HPFAM may fit nicely into some grantees' existing processes but may not apply to others. We briefly outline below a general allocation process that we used to guide model development. Although the steps below are typical, not all jurisdictions use the same approach for allocating prevention resources.

1. Each grantee may consider the jurisdiction as a whole or multiple regions within the jurisdiction when setting priorities for HIV prevention. Each region may therefore have its own list of priorities for HIV prevention.

2. Within each region of a jurisdiction, CPGs meet to identify priority populations for HIV prevention. Grantees use information about priority populations from the CPGs to prepare their applications for federal HIV prevention funds.

3. A request for proposal (RFP) process is used to allocate funds to community-based organizations (CBOs) or local health departments that conduct prevention activities.

4. Once grantees obtain prevention funds from the CDC, they must decide how to allocate those funds, including deciding on the amount of money to offer in RFPs issued to CBOs and local health departments for working with the CPG-designated priority populations.

5. In response to the RFPs, local health departments and CBOs submit proposals to conduct specific prevention activities with specific risk populations.

6. Grantees review proposals and make decisions about which prevention activities to fund and the size of individual awards.

The HPFAM is a tool for grantees to use in step 4 to help determine the amount of money to allocate to different preventive efforts, including the amount to offer in RFPs issued to CBOs and local health departments to work with the CPG-designated priority populations. The tool provides a report that shows the amount of money to allocate to each population to maximize the potential impact of preventive efforts. It also shows the extent to which equity constraints affect the allocation and reduce the potential impact of preventive efforts.

The three main groups involved in the allocation process are the CDC, CPGs, and CDC grantees that make the final allocations to CBOs, local health departments, and other prevention service providers. Exhibit 1-1 outlines some specific objectives of each stakeholder and how the HPFAM satisfies their goals.

1.2 What HPFAM Can (and Cannot) Do

The HPFAM reports a specific allocation of funding among the regions and priority populations in a grantee's state or region. The model results can be used to explore trade-offs measured as a loss in the potential impact of preventive efforts when equity concerns are addressed. It can also be used to assess the potential impact of various allocation strategies.

The allocation report should not be the sole basis for making decisions about allocating prevention funds. Instead, the HPFAM is a ***tool*** to assist decision makers in understanding the likely impact of different allocations on the potential benefits of preventive efforts. Users should remember that many factors are important in allocating resources across populations and regions, such as effectiveness, feasibility, acceptability, and cost-effectiveness. This model is useful only for considering the allocation of available funds that maximizes the potential impact of preventive efforts, where the potential impact is measured as the weighted number of potential infections averted (as described in detail in Section 4.1).

Exhibit 1-1. HPFAM Response to Stakeholder Objectives

Stakeholder	Objective	HPFAM Response
CPG	To identify populations in their jurisdiction to receive priority in the prevention funding process	Accounts for the priorities set by CPGs
CDC	To help jurisdictions move toward achieving the IOM goals of considering the cost and effectiveness of prevention activities in deciding how to allocate prevention resources	Considers costs and infectivity in allocating prevention resources, as recommended by the IOM, by maximizing the potential number of infections averted or the number averted if intervention activities are completely effective
	CPG/health department agreement on funding strategy	Accounts for the priorities set by CPGs
Grantee	To support effective prevention activities aimed at reducing the spread of HIV	Maximizes the potential number of infections averted or the number averted if intervention activities are completely effective
	To allocate funds in accordance with CPGs' selected priority populations	Accounts for the priorities set by CPGs
	To allocate funds equitably across the jurisdiction and across risk groups	Allows for users to balance goals of efficiency and equity and to quantify the expected impact of improving equity
	To decide on an allocation of prevention resources for publication in RFPs	Can be used to develop RFPs that specify the amount of funding available for specific populations by region

1.3 User's Guide Overview

This guide is designed to walk users through the installation and use of the model. We recommend that you review the relevant parts of the model as you read through the remainder of the user's guide. You should then be able to begin using the model in the funding allocation process.

In Section 2 of this guide, we provide brief instructions (including system requirements) for installing and using the HPFAM software. In Section 3, we provide general and specific guidelines for navigating the model. In Sections 4, 5, and 6, we explain each of the data input screens required to use the model. In Section 7, we describe the reports generated by the model. In Section 8, we address frequently asked questions (FAQs) and how to troubleshoot potential errors. In the appendices, we explain the HPFAM formulation and suggest methods for estimating data inputs that are not readily available to the user.

1.4 Comments or Questions

For additional information or if you have any comments, suggestions, or questions, please contact Carol Scotton via e-mail at cxr3@cdc.gov or by telephone at (404) 639-0901.

2. Installation and Setup

2.1 Installing the HPFAM on Your Hard Drive

The HPFAM software requires Microsoft Excel 2000 or later, running under Windows 95 or later, including Windows NT. The "Solver" add-in must be installed on the computer (see ***Section 2.4 Confirming Installation of the Solver Add-in*** if it is not). We assume the user has some knowledge in using My Computer or Microsoft Explorer. Complete the following steps to install the software on the computer's local drive:

1. Insert the "HIV Prevention Funding Allocation Model" CD into the CD-ROM drive.

2. Open Microsoft Explorer or My Computer to search the CD-ROM drive (typically the D:\ or E:\ drive).

3. Copy the files "HPFAM.xls" and "HPFAM User's Guide.pdf" to the desired location on your computer by dragging and dropping.

After completing these steps, the HPFAM software will be installed on the computer.

2.2 Adjusting Excel Security Levels

If this is your first time opening HPFAM.xls on your computer, you will likely need to make some changes to the default security settings for Excel. Because HPFAM uses background programming in macros, certain security settings must be in place for the Solver add-in and other automated functions to perform correctly. If those settings are not in place, Excel will display ambiguous error messages and warning messages about problems recognizing the Solver add-in. Follow the steps below to establish the security settings needed to run HPFAM.xls.

1. Before opening HPFAM.xls, open Excel (with or without another open file), click the "Tools" menu, then "Macro," and finally "Security." You will see two tabs: "Security Level" and "Trusted Sources."

2. Under the "Security Level" tab, choose Low or Medium (Medium is recommended). Click OK to save these settings.

   If the Excel security settings are on Medium, every time the user launches the program, a screen will appear alerting the user that the file contains macros. To proceed, click Enable Macros. If the security settings are on Low, no prompt will appear and the macros will be enabled automatically. High security level will not allow any of the background programming (macros), essential to HPFAM, to run.

3. Under the "Trusted Sources" tab, be sure that both check boxes are selected: "Trust access to Visual Basic Project" and "Trust all installed add-ins and templates."

2.3 Opening the HPFAM

After installing the model and verifying that you have the appropriate security settings for running HPFAM, complete the following steps:

1. Locate and double click on the file named "HPFAM.xls" via Microsoft Explorer or after launching Excel.

2. To protect against viruses, Excel has a security system that allows the user to adjust how it handles macros, by setting that security level to Low, Medium, or High. If the security level is set on Medium, it will provide a warning that the file contains macros. In this case, click on Enable Macros to proceed. If the security level is set on Low, no warning screens will appear.

3. The Welcome screen will appear. Click Continue to proceed.

   If Excel has a problem detecting Solver, despite adjustments to the Excel security levels as outlined in Section 2.2, a form will appear providing directions for investigating and fixing the problem manually (see Section 2.4 for more information).

2.4 Confirming Installation of the Solver Add-in

The Solver add-in needs to be installed and referenced in two places before you can use HPFAM. If Excel has a problem detecting this add-in, "Compile errors" will be displayed. In this case, click on the "Error Message Help" option on the toolbar and follow the instructions below to fix the problem.

Check #1: Click the "Perform first check" button on the form (displayed using the "Error Message Help" button) to see if Excel recognizes Solver. If it does not, you will be instructed to follow the instructions below for searching for and, if necessary, installing Solver on your computer.

Check #2: Close out the form. Press Alt-F11 to get to the Visual Basic Editor (VBE). Double click on the "ResourceAllocationModel (HPFAM.xls)" in the white box on the left-hand side of the screen. Enter the password "RTI." Select "References" on the "Tools" pull-down menu. One of the options should be "SOLVER." That option should also be checked. If it is not listed, use the "Browse" button to find the file called "Solver.xla." See below if you have any problems. Once Solver is an option, select the corresponding check box. Save the file from the VBE screen now. Close VBE.

If both checks are not okay, do a search (via the Start Menu) on your computer for the file called "Solver.xla." This file is often located in the \Office\Library\Solver\ or \Office10\Library\Solver\ subfolder. If you find the Solver subfolder somewhere other than the Library subfolder, move the entire folder to the Library subfolder and repeat Checks 1 and 2.

Finally, if you cannot locate Solver.xla on your computer, you need to install it using your installation CD for Excel and go through the steps listed above.

3. Navigating the HPFAM

In this section, we provide both general and specific guidelines for navigating the HPFAM.

3.1 General Guidelines

The following are general guidelines for navigating and understanding the organization behind the HPFAM:

1. Some grantees may consider the state or local area as one group for the purpose of establishing priority populations, whereas others may divide the area into more than one geographic region based on city, county, or major metropolitan area divisions. Before starting the HPFAM, priority populations for each region should already be identified. These populations may be defined according to risk behaviors, demographic characteristics, or any other way that the CPG has defined priority populations, consistent with the local Comprehensive HIV Prevention Community Plan.

   Florida, for example, divides HIV prevention activities into 17 community planning partnerships. Each partnership is made up of one or more counties; within each partnership, the local CPG identifies 6 to 7 priority populations.

2. The model includes five possible constraints to allow for the user to increase equity across regions and populations. It allows the user to consider as many of those five constraints (0–5) as he thinks appropriate for his jurisdiction. Region- and population-specific values must be set for each selected constraint.

3. Model options should be set first; they determine the amount of funding available for allocation, which equity constraints the user will be able to implement, and the value assigned to parameters used to estimate the potential number of infections averted in each priority population.

   Region-specific information should then be entered second and population-specific information added last, as priority populations for a region cannot be added until the corresponding region has been entered.

4. With principle #3 in mind, the user may return to previous steps to make changes at any time. Exhibit 3-1 outlines considerations that the user should remember when making changes.

5. Each population is specific to a region. If the same risk population exists in several different regions, a separate population must be added for each region. For example, if a grantee wants to target White men who have sex with men (MSM) in three different regions, they must add three populations—one for each region.

Exhibit 3-1. Results of Making Changes to Earlier Steps in the Model

If the User:	After:	Then:
Unselects an equity constraint	Adding region-/population-specific information	That constraint and any values stored that are related to it are removed from memory.
Selects an equity constraint	Adding region-/population-specific information	Default values for that equity constraint will be used until the user enters his own values.
Deletes a region	Adding populations for that region	All populations for the region are deleted also.

6. The model limits funding to a population to the amount that will fund interventions for 100 percent of the individuals. To demonstrate this limit, if the per person intervention cost is $100 in a population of 1,000 people, the model will not allocate more than $100 x 1,000 = $100,000 to that population.

   If the user wants the option to offer more than one intervention per individual, she can set the intervention cost equal to the cost of a package of interventions.

7. Selecting a constraint to ensure equity across regions/populations means that the model adds one constraint for every region/population (e.g., if the user wants a constraint for limiting funding to each of three regions, then the model has three actual constraints—one limiting funding to a specified amount for each region). Each of those region-/population-specific constraints can be set on the screen on which the user sets other region-/population-specific characteristics.

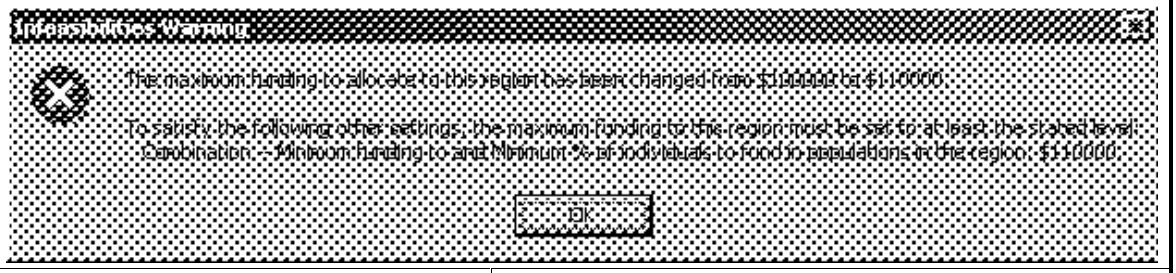
8. If the user selects any equity constraints, the model has to check each region- or population-specific constraint to make sure that it does not make the model "infeasible." An infeasible model is one that has two or more constraints that contradict each other. For example, if a user sets the minimum funding to a population to $30,000 and then tries to set the maximum funding to that same population to $20,000, the model would be infeasible because both constraints cannot possibly be fulfilled simultaneously (the maximum limit cannot be less than the minimum limit).

   As one might expect, if the model is infeasible, it cannot run correctly. For that reason, every time a user changes either the value for the total available funding, a region- or population-specific constraint, or some population-specific parameters that affect equity constraints, the model checks to make sure that the new value does not make the model infeasible. If the model finds that the new value makes the model infeasible, it will flash up an "Infeasibilities Warning" screen alerting the user to the problem. The infeasible value will automatically be changed to one that makes the model "feasible." The warning screen will report three main pieces of information: (1) what other constraint(s) or

combination of constraints the value just entered contradicted; (2) for each of those constraints, to what number the value would have to be changed to satisfy it; and (3) the new value of the funding amount or constraint that makes the model feasible by satisfying all other constraints.

If the value entered contradicts a "combination" of two constraints, then having to satisfy both of those constraints at the same time, along with the new constraint value entered, makes the model infeasible. Exhibit 3-2 shows one example of how this might happen.

Exhibit 3-2. Infeasible Combination Example

Constraints set by the user		
Populations in Region A	Population 1	Population 2
Cost to fund minimum % of individuals in population	$50,000	$50,000
Minimum funding to population	$60,000	$0
⬇		
Looking at those constraints together		
Population allocation that satisfies both population-specific constraints	$60,000	$50,000
Minimum funding to Region A that will satisfy all population-specific constraints	$110,000	
⬇		
New constraint added by user		
Maximum funding to Region A	$100,000	
⬇		
Model's response to new constraint		
		
Maximum funding to Region A	(automatically reset to:) $110,000	

If, in the example in Exhibit 3-2, the user decides that it is important to ensure a minimum funding level of $60,000 to Population 1 and that it is equally important to fund a certain minimum percentage of individuals at a cost of $50,000 for each population, the maximum funding level to Region A would have to be increased to at least $110,000 to ensure that the other two constraints could be satisfied.

On the other hand, a user might decide that a $100,000 limit on funding to Region A is a higher priority than a $60,000 minimum funding amount to Population A. In that case, the user would reduce the latter constraint to $50,000 or less, then reset the former to $100,000.

9. All percentage values (indicated by a "%" symbol) must be between 0 and 100. Two percent, for example, would be represented with a "2" rather than "0.02."

10. Clicking Save on an individual screen will store the user's entries within the model, but it will not save the changes made to the file itself. To save changes made to the model, users should click File and Save from the toolbar. If interested in using the model for different years or different sources of funds to be allocated, a new name should be given to each version of the model saved (e.g., HPFAM_2003.xls or HPFAM_stateHIVfunds.xls).

11. Clicking Cancel on any screen will either return the user to the Switchboard or the previous screen without saving any of the changes made to the screen.

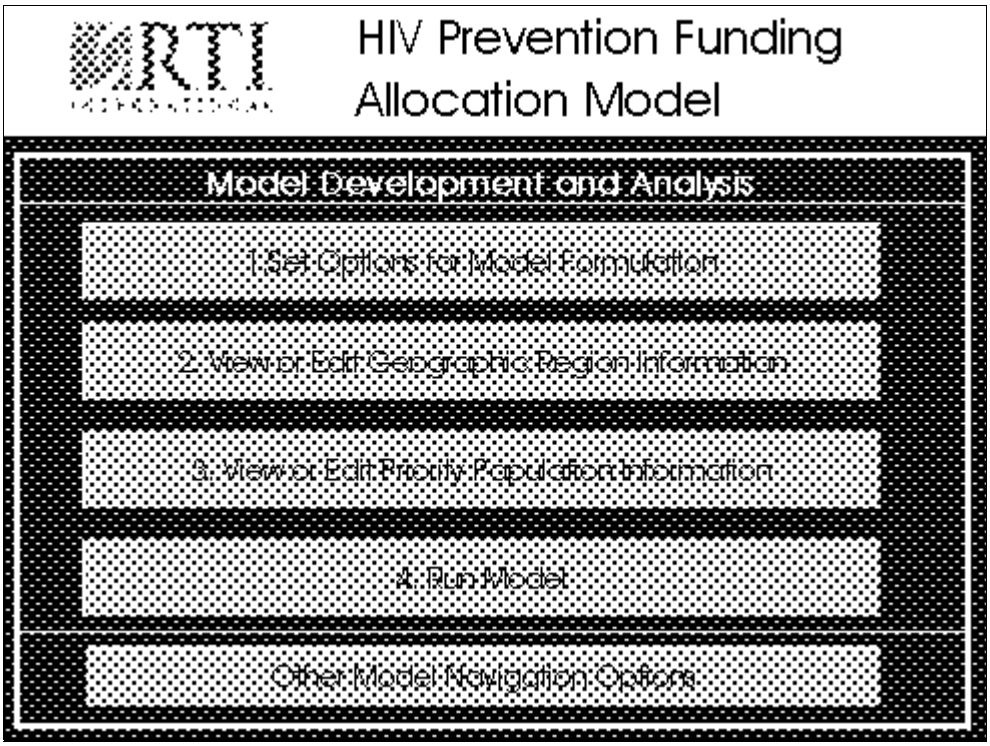
12. Clicking the X button located in the upper right-hand corner on any screen will not allow the user to exit the screen. The user may only exit screens by clicking Cancel, Close, or Return to Switchboard. To exit the file, click File and Exit from the toolbar.

13. The model may be "cleared" by deleting all geographic regions. All populations within each region will also be deleted.

3.2 The Switchboard

The Switchboard (Exhibit 3-3) serves as the center of operations for the model. The file will always open to it and will also return to it after the user closes out of other screens.

Exhibit 3-3. Switchboard



From the Switchboard, the user has several options:

1. Set Options for Model Formulation—Allows the user to enter the amount of funding available for allocation, equity constraints, and parameter values.

2. View or Edit Geographic Region Information—Allows the user to add new regions to the model and edit, view, or delete regions previously entered.

3. View or Edit Priority Population Information—Allows the user to add new populations to the model and edit, view, or delete populations previously entered.

4. Run Model—Runs the allocation model and displays allocation results.

5. Other Model Navigation Options—Allows the user to view the most recent model results, scenario comparison, and model formulation details and to obtain instructions for checking for the installation of the Solver add-in.

4. Setting the Model Formulation Options

From the Switchboard, click 1. Set Options for Model Formulation. The Options screen appears.

The Options screen contains five tabs for setting formulation options. The following sections describe the function of and explain how to use each of these tabs. For all fields for which the user must enter information, we provide details on what the user should enter, as well as the model's default values for each.

4.1 Objective

On this tab, the objective of the model is stated: "to allocate available HIV prevention funds across priority populations in a jurisdiction in a way that both maximizes the number of potential infections averted by HIV prevention interventions and represents the priorities expressed by CPGs."

The HPFAM allocates available funds to maximize the weighted number of potential infections averted, where the weights represent the CPG priorities for prevention. The model refers to the weighted number of potential infections averted as the "Potential Impact Index" (we will refer to it in this document as "the Index"). The Index is the sum across all populations of the population's potential number of infections averted multiplied by the population weight assigned by the CPG(s). We estimate that value using a Bernoulli model developed by Pinkerton and Abramson (1998) that is based on a population's risk behaviors, the prevalence of HIV in the population, and the financial cost of reaching those individuals for implementing interventions. More details on the actual formulas used are presented in **Appendix A**. For more on the population weight, see Section 6.1.1.

4.2 Available Funding

The screen associated with this tab (Exhibit 4-1) allows the user to enter an amount of funding from the CDC and/or other sources available for allocating across all populations. This funding does not include funding that is already specifically designated to go to a particular population; it only includes funding that the user has discretion to allocate. A single amount may be entered in the first row if the user does not wish to identify individual sources of funding to be allocated. Exhibit 4-2 describes each field in more detail.

If the user enters an infeasible value for the total available funding (based on any other constraints already entered in the model), a warning will appear, notifying the user that the constraint will be automatically changed to the minimum feasible value. See General Guideline #8 for more explanation.

Exhibit 4-1. Available Funding Tab

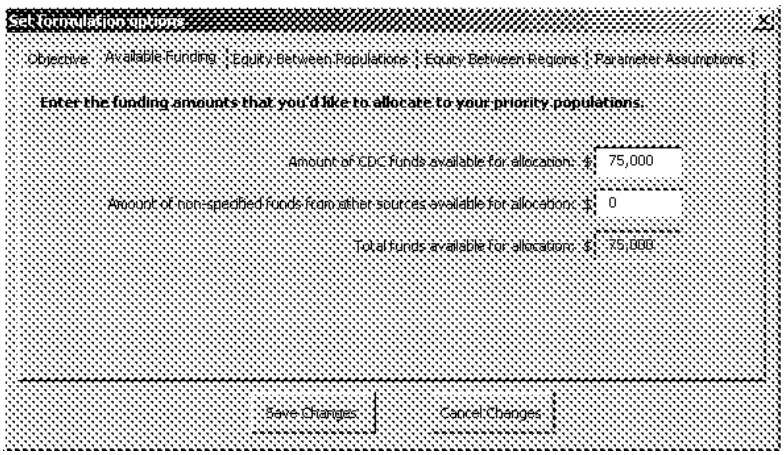


Exhibit 4-2. Available Funding Fields

Field	What to Enter
Primary funding source	Amount of funding available for allocating to CBOs and/or health departments to implement prevention interventions
Other funding	Total amount of funding available from all other sources besides the primary funding source for allocating to CBOs and/or health departments for prevention interventions
Total funding	Automatically calculated as sum of primary and other funding

4.3 Equity between Populations

This screen (Exhibit 4-3) allows the user to denote the constraints to apply to ensure equity between priority populations. Three types of constraints are available: (1) fund at least a minimum percentage of the population to receive interventions, (2) allocate at least a minimum amount of funding to a population, and (3) allocate no more than a maximum amount of funding to a population. Exhibit 4-4 lists the default values for each constraint.

A check in the box next to a constraint indicates that the user would like to apply that constraint to all of its populations. Only the "checked" constraints will appear on the screen for adding or editing a population; on that screen, the user can set the actual value applied to the constraint for each particular population. For example, the user may "check" the constraint to require a minimum percentage of a population to receive funding for interventions. He may set that requirement to the same amount (e.g., 50 percent) for all populations or he may instead set the requirement to 50 percent of one population, 15 percent of another, and 0 percent of another.

Exhibit 4-3. Equity between Populations Tab

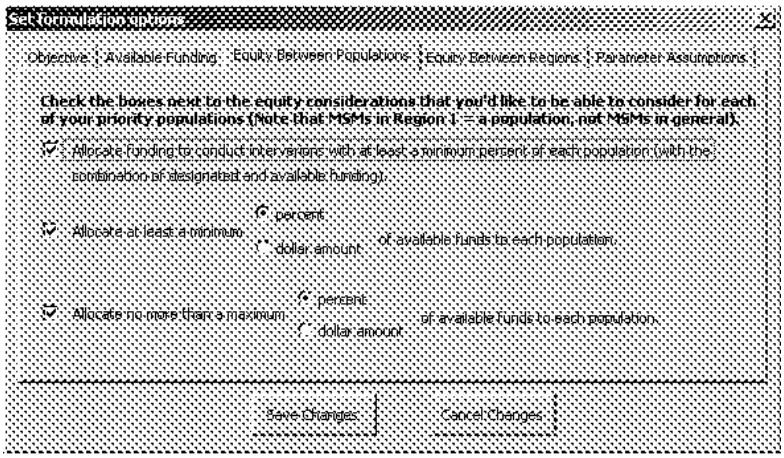


Exhibit 4-4. Equity between Populations Constraints

Field	Default Value
Fund at least a minimum percentage of the population to receive funding for interventions	0%
Allocate at least a minimum amount of funding to a population	Percent: 0% Dollar: $0
Allocate no more than a maximum amount of funding to a population	Percent: 100% Dollar: Total available funding ($)

For the latter two constraints, if checked, the user has the option to base the constraint on either percentage of funding or a specific dollar amount. As an example, if total available funding is $100,000 and the user wants at least $10,000 (= 10 percent of funding) to go to a population, he would enter “10” if he had selected “percent” or “10,000” if he had selected “dollar.”

4.4 Equity between Regions

This screen (Exhibit 4-5) allows the user to denote the constraints to apply to ensure equity between geographic regions. These constraints would only be relevant if the user’s jurisdiction contained more than one region. Two types of constraints are available: (1) allocate at least a minimum amount of funding to a region, and (2) allocate no more than a maximum amount of funding to a region. Exhibit 4-6 lists the default values for each constraint.

Exhibit 4-5. Equity between Regions Tab

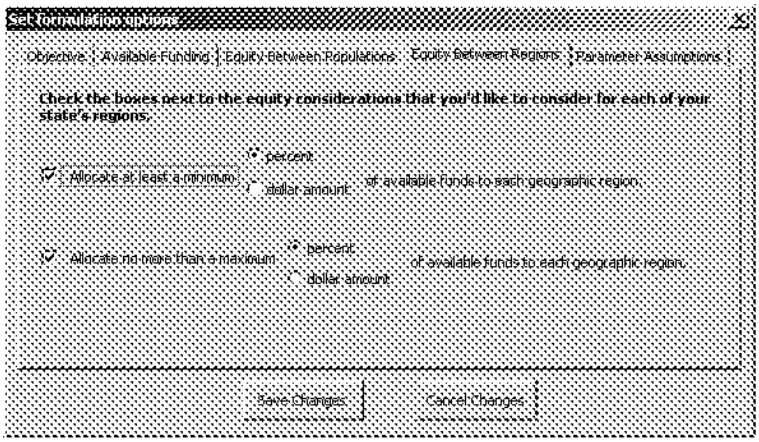


Exhibit 4-6. Equity between Regions Constraints

Field	Default Value
Allocate at least a minimum amount of funding to a region	Percent: 0% Dollar: $0
Allocate no more than a maximum amount of funding to a region	Percent: 100% Dollar: Total available funding ($)

As with the constraints setting equity between populations, a check in the box next to a constraint indicates that the user would like to apply that constraint to all of its regions. Only the "checked" constraints will appear on the screen for adding or editing a region; on that screen, the user can set the actual value applied to the constraint for each particular population. The user has the option on both constraints to base the constraint values on either percentage of funding or a specific dollar amount.

4.5 Parameter Assumptions

The Parameter Assumptions screen (Exhibit 4-7) allows the user to enter values for the infectivity and effectiveness of using protection while engaging in transmission risk—either sexual or needle-sharing—behaviors. These values are part of the calculation of the potential number of infections that would be expected in each priority population in the absence of preventive interventions. Exhibit 4-8 describes each field in more detail.

Default value sources and methodologies and other potential sources for obtaining information required for the Parameter Assumptions tab are described in **Appendix B**.

When finished selecting formulation options from all five tabs, click Save Changes to save changes to the fields on all five screens.

Exhibit 4-7. Parameter Assumptions Tab

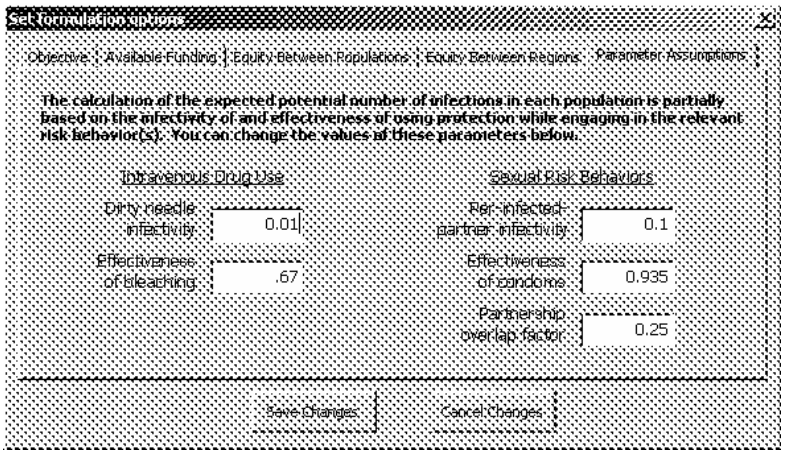


Exhibit 4-8. Parameter Assumptions Fields

Field	What to Enter	Default Value
Dirty needle infectivity	The average probability of HIV transmission from a needle previously used by an infected person per contact	0.01
Effectiveness of bleaching	The probability that an infected syringe is disinfected (HIV is removed) after rinsing with diluted bleach	0.67
Per-infected partner infectivity	The probability of HIV transmission from sexual intercourse (vaginal and anal) with an infected partner	0.1
Effectiveness of condoms	The probability that HIV transmission is prevented by using a condom during sexual intercourse (vaginal or anal)	0.935
Partnership overlap factor	The percentage of an HIV-positive individual's sexual partners who are also sexual partners with other HIV-positive persons	0.25

5. Information Describing Geographic Regions

To add, view, or edit a geographic region, click 2. View or Edit Geographic Region Information from the Switchboard. The user is given the following options from the screen that appears (in the case that no regions are stored in the model, only the first option will be offered, since the others would be irrelevant):

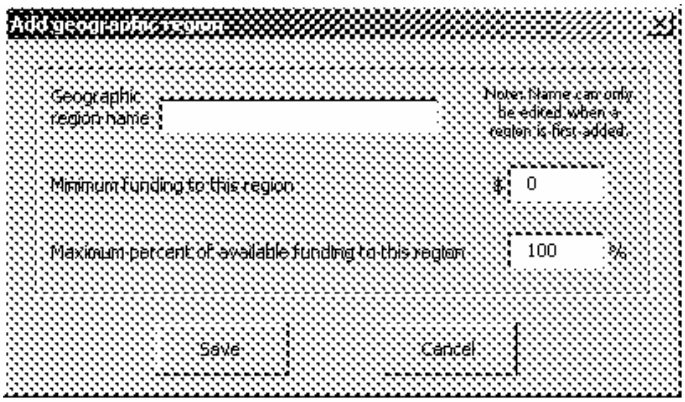
- Add a new geographic region.
- Edit information for a geographic region already entered in the model.
- Delete geographic region(s) from the model.
- View information about geographic regions already entered in the model.

Selecting one of the buttons and clicking on Go will take the user to the relevant screen. The four choices are described below. Clicking on Return to Switchboard will close this form and take the user back to the Switchboard.

5.1 Add a New Geographic Region

This option leads the user to a screen for adding a geographic region to the model. Only those equity constraints checked under Model Options are offered to the user. In Exhibit 5-1, both equity constraints were selected—the first as a dollar amount and the second as a percentage of available funding.

Exhibit 5-1. Add Geographic Region Screen



5.1.1 Entering Information into Input Boxes

Geographic Region Name

From this screen, the user can enter a unique name to identify the geographic region. The name cannot begin with a numeric character and can only be edited when the region is first added.

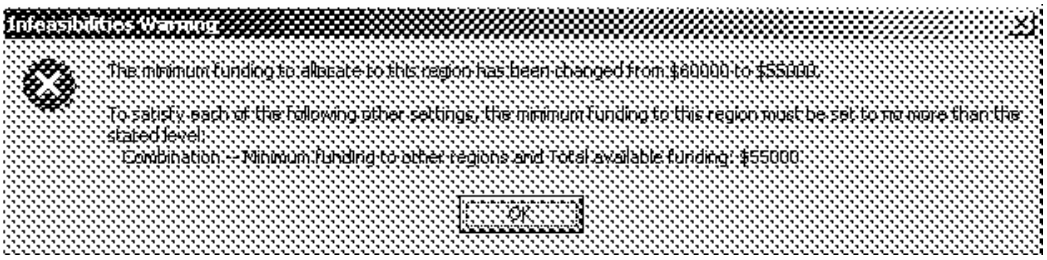
Equity Constraints

Depending on which constraints are selected (and therefore displayed on the screen), the user should enter values for equity constraints in terms of percentages of total funding or dollar amounts. Exhibit 5-1 depicts a situation where the user has selected dollar amount for the minimum funding constraint and percentage for the maximum funding constraint.

5.1.2 Infeasible Equity Constraint Values

If the user enters an infeasible value for either constraint (based on other geographic region constraint information already entered), a warning will appear, notifying the user that the constraint will be automatically changed to a feasible value. See General Guideline #8 for more explanation. Exhibit 5-2 presents an example of an infeasibilities warning screen.

Exhibit 5-2. Infeasibilities Warning Screen



5.1.3 Leaving this Screen

To save the information on a newly added geographic region, click Save. After clicking Save, a screen will appear asking if the user would like to add another geographic region. Click Yes to return to the Add Geographic Region screen. Click No to return to the Geographic Region Options screen.

When finished adding all geographic regions, click Return to Switchboard from the Geographic Region Options screen to return to the Switchboard.

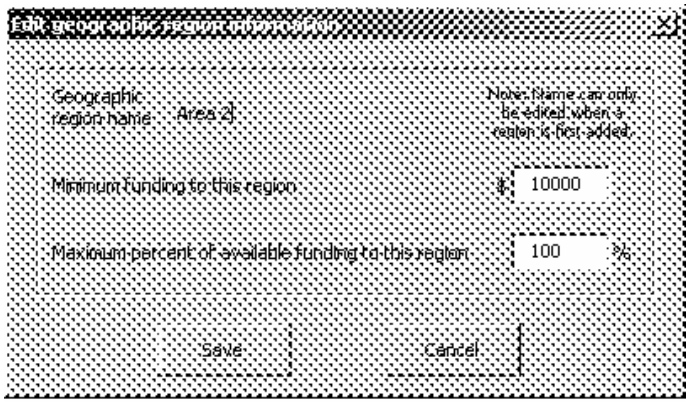
5.2 Edit Information for a Geographic Region Already Entered in the Model

The user will first be prompted to choose the existing region to edit. Select a region from the pull-down list and click "Edit this region." The Edit Geographic Region information screen appears (Exhibit 5-3).

5.2.1 Entering Information into Input Boxes

This screen functions very similarly to the screen used to add a new region (see Section 5.1). The only difference is that the region name cannot be edited; it can only be changed when the region is first added. To change a region name, the region must first be deleted and then added again.

Exhibit 5-3. Edit Geographic Region Information Screen



5.2.2 Leaving this Screen

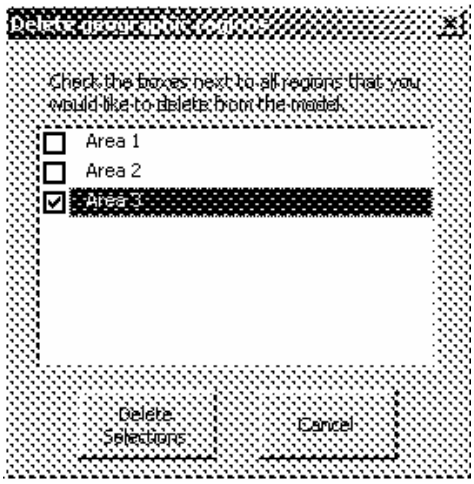
To save changes, click Save. A screen will appear asking if the user would like to edit another geographic region. Click Yes to return to the region selection pull-down menu. Click No to return to the Geographic Region Options screen.

When finished editing all geographic regions, click Return to Switchboard from the Geographic Region Options screen to return to the Switchboard.

5.3 Delete Geographic Region(s) from the Model

The Delete Geographic Regions screen is presented in Exhibit 5-4. Check the box next to the region(s) to delete and click Delete Selections.

Exhibit 5-4. Delete Geographic Regions Screen

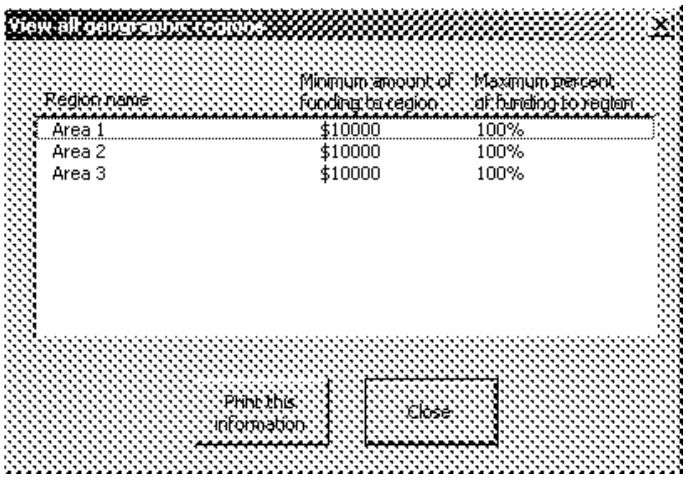


If any populations exist in any of the regions selected, deleting a region will automatically delete its population(s) as well. A confirmation message box will appear. Click Yes to confirm the selections and return to the Geographic Region Options screen, or click No to return to the Delete Geographic Regions screen.

5.4 View Information about Geographic Regions Already Entered in the Model

A table will appear with each geographic region's name and stored values for any of the equity constraints selected (Exhibit 5-5). The list of regions may be printed for future reference by pressing the Print this information button. Click Close to return to the Geographic Region Options screen.

Exhibit 5-5. View Geographic Regions Screen



6. Information Describing Priority Populations

To add, view, or edit a population, click 3. View or Edit Priority Population Information from the Switchboard. The user is given the following options from the screen that appears (the "Population Options" screen). In the case that no populations are stored in the model, only the first option will be offered, since the others would be irrelevant:

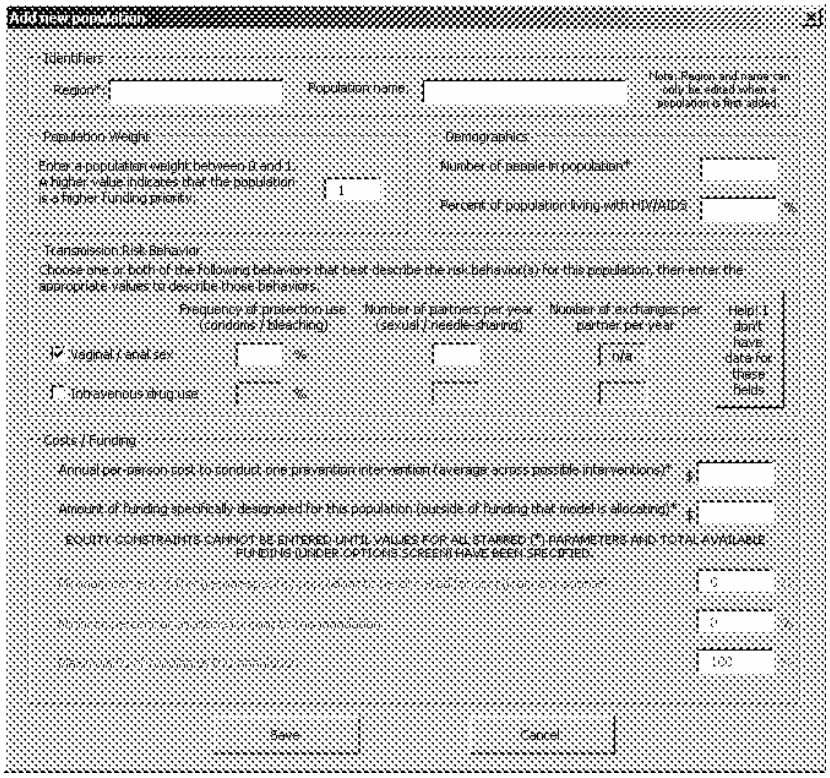
- Add a new population.
- Edit information for a population already entered in the model.
- Delete population(s) from the model.
- View information about populations already entered in the model.

Selecting one of the buttons and clicking on Go will take the user to the relevant screen. The four choices are described below. Clicking on Return to Switchboard will close this form and take the user back to the Switchboard.

6.1 Add a New Population

This option leads to a screen that allows the user to add a population to the model. Only those equity constraints checked under Model Options are offered to the user. In Exhibit 6-1, all three equity constraints were selected.

Exhibit 6-1. Add New Population Screen



Several fields on this screen require population-specific information or parameter estimates. Any equity constraints relevant to populations that the user has selected will be shown on the screen; however, they will be dimmed and unusable until the user has entered values for the following fields: region, number of people in population, intervention cost, and outside funding.

6.1.1 Entering Information into Input Boxes

We describe each field below. **Appendix B** includes guidance for gathering population-specific information. If the information is not available, **Appendix B** also includes values from the literature that may be used as estimates of parameter values.

Region

Using the pull-down menu, select the geographic region of the priority population to be added. If the associated region is not listed, then it is not yet added to the model. In that case, the user should cancel the population addition, add the region, and try again. Note that this field cannot be changed when editing a population, only when it is first added.

Population Name

Enter a unique name to identify the population. The name assigned is entirely up to the user and need not be based on the risk behaviors or demographic characteristics of the population. Note that the population name cannot begin with a numeric character and can only be edited when the population is first added.

Population Weight

The population weight is a factor (0–1) assigned by the CPG(s) and used in the HPFAM to weight populations by priority. Populations with higher weights will be considered more favorably in the allocation. Populations can be assumed to have equal priority by setting all of the weights to the same number (for example, all equal to 1). Note that population weights within a region and across all regions do not have to sum to one.

Number of People in Population

Enter an estimate of the total number of infected and uninfected people in the priority population.

Percent of Population Living with HIV/AIDS

Enter an estimate of the percentage (0–100) of the priority population that is living with HIV/AIDS. This estimate should reflect the user's best guess of the actual level of infection among the population, rather than the documented prevalence within a population.

Vaginal/Anal Sex

Check the box next to vaginal/anal sex if that is a risk behavior toward which interventions would be directed with this priority population. Once checked, fields related to the behavior will become accessible. Note that this box and the intravenous

drug use box can be checked at the same time if relevant (e.g., commercial sex workers who also inject drugs).

Frequency of Protection Use

Represents the frequency of condom use in the absence of intervention (i.e., the status quo). Enter the estimated percentage (0–100) of the priority population that reports having used a condom at last sexual intercourse.

Number of Partners Per Year

Represents the number of sexual partners in the absence of intervention (i.e., the status quo). Enter the average number of different people a member of the priority population has sex with per year.

Intravenous Drug Use

Check the box next to intravenous drug use if that is a risk behavior toward which interventions would be directed with this priority population. Once checked, fields related to the behavior will become accessible. Note that this box and the vaginal/anal sex box can both be checked if relevant.

Frequency of Protection Use

Represents the frequency of bleach use in the absence of intervention (i.e., the status quo). Enter the estimated percentage (0–100) of the priority population that reports having always used bleach to disinfect used syringes.

Number of Partners Per Year

Represents the number of needle-sharing partners in the absence of intervention (i.e., the status quo). Enter the average number of different people a member of the priority population shares needles with per year.

Number of Exchanges Per Partner Per Year

Represents the number of needle exchanges in the absence of intervention (i.e., the status quo). Enter the average number of needle exchanges by a member of the priority population per needle exchange partner per year.

Annual Per Person Cost to Conduct Prevention Interventions

Enter the projected cost per person to carry out one prevention intervention during the budget period. This value is an average across all possible interventions for the priority population or the “typical” cost of conducting an intervention with one person. It can also represent the cost of a package of interventions.

Amount of Funding Specifically Designated for the Population Outside the Model

Enter the amount of funding previously allocated to prevention interventions for the priority population.

Minimum Percentage of Population to Receive Funding (if selected on the Options screen)

Enter the minimum percentage of the priority population to receive funding, considering both the specifically designated funding and funding available for allocation. The selection of this option will ensure an allocation equal to the amount of money required to provide interventions for the specified minimum percentage of the population. In other words, it ensures an allocation equal to the minimum number in the population to be funded (i.e., the minimum percentage of the population to receive funding times population size) multiplied by the annual cost per person.

Minimum Amount/Percentage of Funding to the Population (if selected on the Options screen)

Enter the minimum amount/percentage of funding to be allocated to the population.

Maximum Amount/Percentage of Funding to the Population (if selected on the Options screen)

Enter the maximum amount/percentage of funding to be allocated to the population.

6.1.2 Leaving this Screen

To save the information on a newly added geographic region, click Save. After clicking Save, a screen will appear asking if the user would like to add another geographic region. Click Yes to return to the Add Geographic Region screen. Click No to return to the Geographic Region Options screen.

When finished adding all geographic regions, click Return to Switchboard from the Geographic Region Options screen to return to the Switchboard.

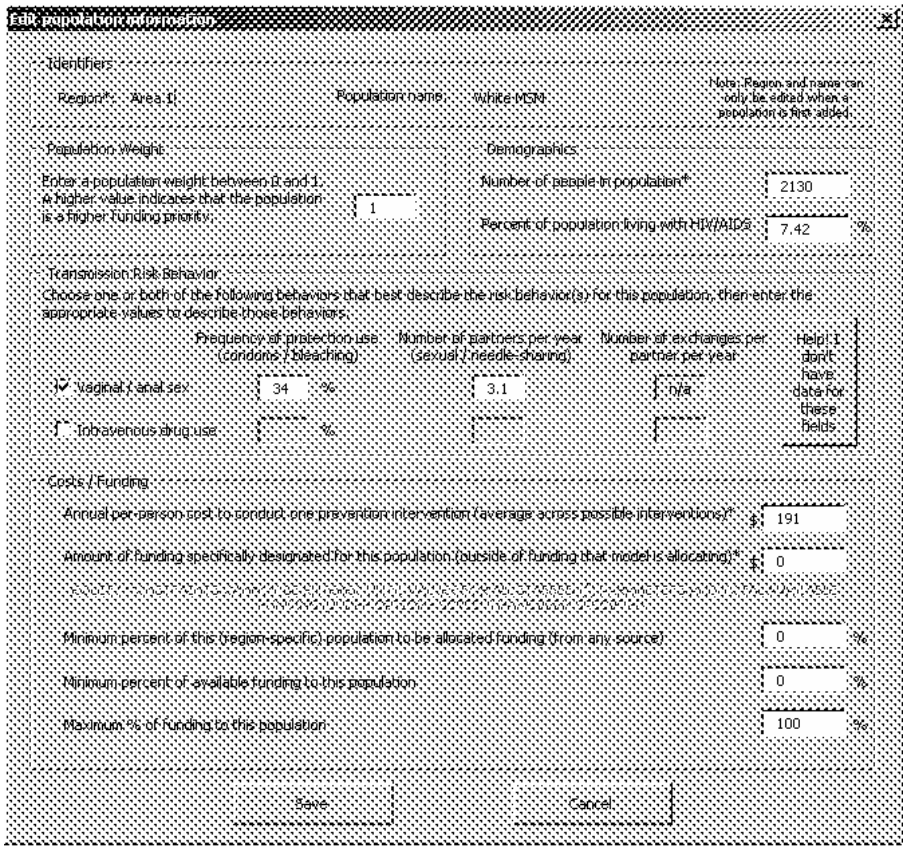
6.2 Edit Information for a Population Already Entered in the Model

The user will first be prompted to choose the existing population to edit. Select a population from the pull-down list and click "Edit this population." The Edit Population Information screen appears (Exhibit 6-2).

6.2.1 Entering Information into Input Boxes

This screen functions very similarly to the screen used to add a new population (see Section 6.1.1). The only difference is that the population name cannot be edited; it can only be changed when the population is first added. To change a population name, the population must first be deleted and then added again.

Exhibit 6-2. Edit Population Information Screen



6.2.2 Leaving this Screen

To save changes, click Save. A screen will appear asking if the user would like to edit another population. Click Yes to return to the Edit Population Information screen. Click No to return to the Population Options screen.

When finished editing populations, click Return to Switchboard from the Priority Population Options screen to return to the Switchboard.

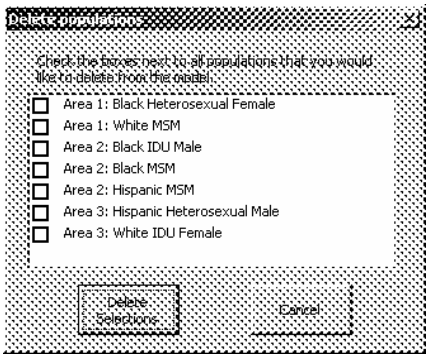
6.3 Delete Population(s) from the Model

The Delete Population screen is presented in Exhibit 6-3. Check the box next to the region(s) to delete and click Delete Selections.

After clicking Delete Selections, a confirmation message box will appear. Click Yes to confirm your selections and return to the Geographic Region Options screen or click No to return to the Delete Geographic Regions screen.

The user will be alerted if deleting at least one of the selected populations would cause the model to become infeasible. The user must change the associated constraints before deleting the listed populations.

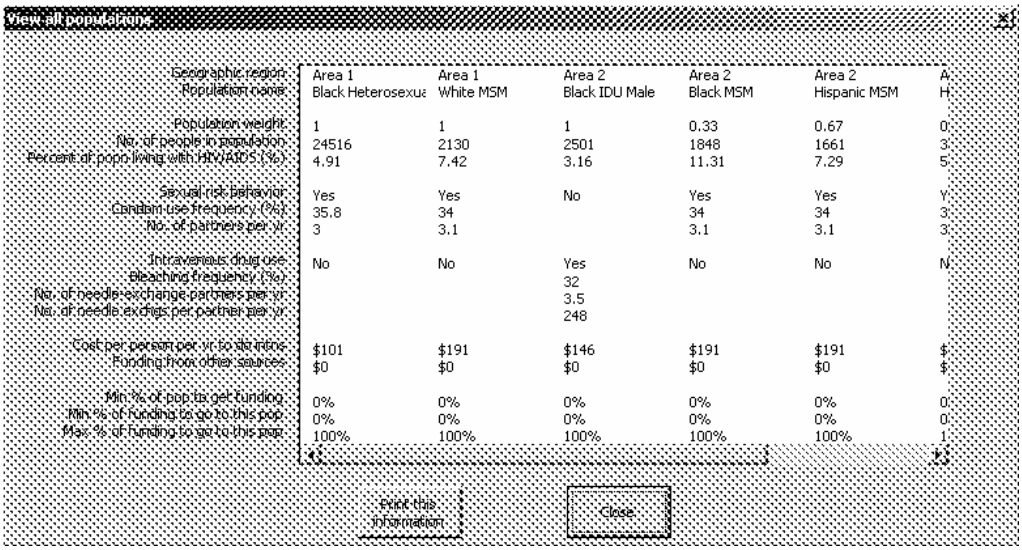
Exhibit 6-3. Delete Population Screen



6.4 View Information about Populations Already Entered in the Model

A table will appear with each population's name, parameter inputs, and stored values for any of the equity constraints selected (Exhibit 6-4). The list of populations may be printed for future reference by pressing the Print this information button. Click Close to return to the Priority Population Options screen.

Exhibit 6-4. View All Populations Screen



7. Generating and Understanding the Resource Allocation Results

Once the Model formulation options have been selected and geographic regions and priority populations entered (in that order), the model is ready to be run. To run the model, click Run Model from the Switchboard. The Results screen presenting the model's resource allocation results will automatically appear.

7.1 Results Screen

An example Results screen, an Excel worksheet, is presented in Exhibit 7-1. The user can view this screen using two methods. One is by running the model; the Results screen is automatically opened once the calculations are complete. The user can also, at any time, click the Other Model Navigation Options button on the Switchboard, then choose "View most recent results" to see the results from the last time that the resource allocation model was run. This screen gives the user a summary of some of the resource allocation inputs and results.

Exhibit 7-1. Resource Allocation Results Screen

Resource Allocation Results

Close Resource Allocation Results | Store this scenario for comparison | View Sensitivity Analysis

	Population Inputs		Allocation of Funds			Potential Impact (Utility)		
Region / Priority population	Population size	Funds already designated to population / region	Funds allocated to population / region	Percent of funding allocated to population / region	Percent of population receiving intervention	Potential number of infections averted	Population weight	Potential Impact (Utility) = Potential no. of infections averted * Population weight
Area 1		**$6**	**$-**	**0%**		**0.00**		**0.00**
Population 1	1000	$6	$-	0%	0%	0.00	1.00	0.00
Area 2		**$-**	**$31,500**	**42%**		**11.61**		**11.61**
Population 2	400	$-	$31,500	42%	39%	11.61	1.00	11.61
Area 3		**$10,000**	**$43,500**	**58%**		**62.20**		**62.20**
Population 3	300	$10,000	$43,500	58%	100%	62.20	1.00	62.20
Total			**$75,000**	**100%**		**73.81**		**73.81**

7.1.1 Explanation of Reported Information

For each region, a row with bolded font shows the combined allocation results for all of its populations. Below each of these rows are the results by individual population. Each column presented on the Results screen is described below.

Region/Priority Population, Population Size, and Funds Already Designated to Population/Region

Population-specific input information entered by the user before running the model.

Funds Allocated to the Population/Region

Presents the funding allocation calculated by the model based on the population and region information and equity constraints entered by the user. Given those inputs, this allocation maximizes the value of the Index (see the "CPG Priority-Potential Effectiveness Index" column).

The total amount of funding allocated to populations is also reported in bold in the bottom row of the column. This value should equal the total amount of funding available for allocation. In some cases, however, the model may only allocate a portion of the available funding due to equity constraints that restrict the amount of funding to populations and regions. If this happens, a comment box will appear alerting the user to the problem; the user should then edit the constraint to allow for more money to be allocated to the regions and populations (See **Section 8.2 Troubleshooting** for more information).

Percent of Funding Allocated to Population/Region

Presents the percentage breakdown of the allocated funding by population and region. The sum of these percentages is reported in the last row of the column. If this sum is less than 100 percent, a comment box will appear alerting the user that not all of the available funding was allocated. See "Funds Allocated to the Population/Region" above for more on that scenario.

Percent of Population

Reports the percentage of the total risk population that the model has determined could be served at the estimated average cost of preventive efforts. This number is based on the number of people in the population, the amount of funding allocated to the population, and the per person intervention cost.

Potential Number of Infections Averted

Presents the model's estimate of the expected number of infections in the next year in the absence of intervention for the populations to which prevention funds were allocated. Because the maximum possible impact of intervention would be to avert all infections expected in the coming year, the model refers to this outcome as the potential number of infections averted.

For example, in Area 2 shown in Exhibit 7-1, an allocation of $55,000 would allow interventions to be implemented with some of the people in its priority populations. Among those people in Area 2's risk populations who would receive interventions, we would expect, and therefore potentially be able to prevent, an estimated 68 new HIV infections.

Population Weight

Represents the population weight assigned by the user's CPG(s).

Potential Impact Index

Reports a value, for each population, equal to the potential number of infections averted multiplied by the population weight (from the previous two columns). This measure incorporates both the CPG's priorities and the potential number of infections averted through preventive efforts. The sum of the potential impact indices for all populations in a region is also reported. The objective of this model is to find an allocation that maximizes the sum of these values across all populations (reported in the last row of the column).

7.1.2 Navigation Buttons

Three buttons are presented at the top of the Results screen:

- Close Resource Allocation Results
- Store the Scenario for Comparison
- View Sensitivity Analysis

Close Resource Allocation Results

Closes the Results screen and returns the user to the Switchboard. The current results will be saved until the next model run, at which time they will be written over by the next run's results. At any time, however, the user can reopen and view this screen by clicking the "Other Model Navigation Options" button on the Switchboard, then choosing "View most recent results."

Store the Scenario for Comparison

Saves the funding allocation by regions and populations and the Index sum in a table for comparison with other scenarios. See **Section 7.3** for more information.

View Sensitivity Analysis

Allows the user to view the impact and importance of the allocation constraints on the resource allocation results. See **Section 7.2** for more information.

7.2 Sensitivity Analysis

Not all constraints involved in the model end up having an impact on the final allocation. Say, for example, that the minimum funding amount for a region is set to $10,000 and the model's final allocation to that region is $15,000. Since $15,000 is greater than $10,000, we know that that constraint *does not* have an impact on the allocation. If it *did* have an impact on the allocation, then the region would get exactly the minimum amount specified, $10,000. If constraints that *do not* have an impact on the allocation are changed by a little bit (for example, $10,000 is increased to $10,100), the allocation will not change. If, on the other hand, constraints that *do* have an impact on the allocation are changed by a small amount, then the entire allocation will change.

In turn, among those constraints that *do* have an impact on the allocation, some have more of an impact than others. What this means is that a $1 change to the amount

associated with one constraint will increase or decrease the Index by more than a change of $1 to the dollar amount associated with another constraint.

An example Sensitivity Analysis screen, an Excel worksheet, is presented in Exhibit 7-2. A user can view the sensitivity analysis by clicking on the View Sensitivity Analysis button on the Results screen. The information on this screen tells the user whether each constraint has an impact on the allocation and, for those that do have an impact, how they rank in degree of impact.

Exhibit 7-2. Sensitivity Analysis Screen

Resource Allocation Sensitivity Analysis — Close Sensitivity Analysis

Some Constraints Impact the Allocation of Funds While Others Do Not

Constraints that Impact the Allocation:

- Constraints that impact the allocation have an X in the "Impacts Allocation" column.
- Even a small change to any of these constraints will alter the allocation.
- The "Rank" column orders the constraints that impact the allocation according to the strength of the impact.

Constraints that Do Not Impact the Allocation:

- These constraints have an X in the "Does Not Impact Allocation" column.
- A small change to any of these constraints will not alter the allocation.
- A large change to any of these constraints may alter the allocation.

Constraints that Can Be Unchecked in the "Set Options for Model Formulation" Form:

If an equity constraint has an X in the "Does Not Impact Allocation" column for every region or population, then unchecking the corresponding equity constraint type in the "Set Options for Model Formulation" form will not alter the allocation, as long as all parameters and other constraints remain unchanged.

Which Constraints Impact the Current Allocation of Funds?

Constraint	Region/Population	Impacts Allocation	Rank	Does Not Impact Allocation
Available funding		X	2	
Minimum percent of each population	Area 1: Black Heterosexual Female			X
	Area 1: White MSM			X
	Area 2: Black IDU Male			X
	Area 2: Black MSM			X
	Area 2: Hispanic MSM			X
	Area 3: Hispanic Heterosexual Male			X
	Area 3: White IDU Female			X
Minimum funding to each region	Area 1	X	6	
	Area 2			X
	Area 3	X	5	
Minimum funding to each population	Area 1: Black Heterosexual Female			X
	Area 1: White MSM	X	7	
	Area 2: Black IDU Male			X
	Area 2: Black MSM	X	3	
	Area 2: Hispanic MSM	X	4	

7.2.1 Constraints

The model has seven constraints that may impact the allocation results: one funding constraint (1), one constraint limiting the percentage of the population funded to 100 percent (2), and five region- and population-specific equity constraints (3 through 7):

1. *Available funding*
   The model can only allocate as much funding as the user indicates is available in the Options screen in the “Total Funding” field.

2. *Maximum percent of each population = 100*
   The model limits funding to a population to the amount that will fund interventions for 100 percent of the individuals. This constraint is not set by the user but is

equal to the population size multiplied by the expected cost per person to intervene.

3. *Minimum percent of each population*
   This constraint corresponds with the "Allocate funding to conduct interventions with at least a minimum percent of each population (with the combination of designated and available funding)" equity constraint on the Options screen. If that constraint is selected by the user, the model will allocate funding to at least the percentage of each population specified as the "Minimum percent of this (region-specific) population to be allocated funding (from any source)" on the population input screen. This constraint establishes a lower limit on the amount of funding to each population that equals the minimum number of people in a population to fund (calculated as the minimum percentage of the population to be funded multiplied by the population size) multiplied by the expected cost of prevention intervention for the population.

4. *Minimum funding to each region*
   This constraint corresponds with the "Allocate at least a minimum percent/dollar amount of available funding to each geographic region" equity constraint on the Options screen. If that constraint is selected by the user, the model will allocate at least the amount specified as the "Minimum (percent of available) funding to this region" on the geographic region input screen.

5. *Maximum funding to each region*
   This constraint corresponds with the "Allocate no more than a maximum percent/dollar amount of available funding to each geographic region" equity constraint on the Options screen. If that constraint is selected by the user, the model will allocate no more than is specified as the "Maximum (percent of available) funding to this region" on the geographic region input screen.

6. *Minimum funding to each population*
   This constraint corresponds with the "Allocate at least a minimum percent/dollar amount of available funding to each population" equity constraint on the Options screen. If that constraint is selected by the user, the model will allocate at least the amount specified as the "Minimum (percent of available) funding to this population" on the population input screen. Constraint 3 also effectively places a lower limit on the amount of funding to each population; however, it differs from constraint 6 in that the funding limit is established as a function of the percentage of the population the user wishes to serve, whereas constraint 6 establishes the funding limit as a percentage of available funds.

7. *Maximum funding to each population*
   This constraint corresponds with the "Allocate no more than a maximum percent/dollar amount of available funding to each population" equity constraint on the Options screen. If that constraint is selected by the user, the model will allocate no more than is specified as the "Maximum (percent of available) funding to this population" on the population input screen.

7.2.2 Interpreting the Sensitivity Analysis Screen

Constraints that *do* impact the allocation results have an "X" in the "Impacts Allocation" column. These constraints, when changed by a small amount, will affect the allocation. These constraints are also ranked numerically in the "Rank" column according to the relative magnitude of their impact. For example, a constraint with a ranking of 5 will affect the allocation solution by more than a constraint with a ranking of 6 when both constraints are changed by the same small amount.

Constraints that *do not* impact the allocation results have an "X" in the "Does Not Impact Allocation" column. These constraints, when changed by a small amount, will not affect the allocation. If an equity constraint has an "X" in the "Does Not Impact Allocation" column for every region or population, then unchecking the corresponding equity constraint type in the "Set Options for Model Formulation" form will not alter the allocation, as long as all parameters and other constraints remain unchanged.

Keep in mind that changing any constraint by a large amount may alter the allocation completely. Sensitivity analysis results are only relevant when considering small changes.

7.2.3 Leaving this Screen

To return to the Results screen, click Close Sensitivity Analysis.

7.3 Saving Results

To save the allocation results displayed on the Results screen for comparison with other scenarios (stored on the Scenario Comparison screen), click Store this scenario for comparison from the Results screen.

In order to store and compare scenarios' results, those scenarios must include the same regions and populations. If the scenario to be saved does not include the same regions and/or populations as previously saved on the Scenario Comparison screen, the Region/Population mismatch screen will appear. Click Yes to replace previously saved sets of regions/populations with the current scenario's set. This will delete all previous scenarios. Click No to return to the Results screen (see **Section 8.2** for more information).

7.3.1 Naming a Scenario

A screen will appear prompting the user to enter a unique, descriptive name of less than 30 characters to associate with the results. That name should be one that allows the user to identify the scenario in comparison with other scenarios. The scenario name cannot be blank or a duplicate of a previously stored scenario. After entering a name, click Enter to continue.

7.3.2 Scenario Comparison Screen

After naming the scenario, the Scenario Comparison screen, an Excel worksheet, will appear (Exhibit 7-3). The Scenario Comparison screen lists each population and the amount of funding allocated by the model. For simplicity, only the funding allocation by regions and populations and the Index sum are saved.

Exhibit 7-3. Scenario Comparison Screen

Scenario Comparison

Close Scenario Comparison | Clear selected scenarios | Generate allocation chart

Scenario		1: No Constraints		2: Min to each region = $10000		3: 2 & Add Max to pop = $40000	
Potential Impact Index		73.81		71.60		68.82	
Area 1		$0		$10,000		$10,000	
	Population 1		$0		$10,000		$10,000
Area 2		$31,500		$21,500		$25,000	
	Population 2		$31,500		$21,500		$25,000
Area 3		$43,500		$43,500		$40,000	
	Population 3		$43,500		$43,500		$40,000
Total		$75,000		$75,000		$75,000	

7.3.3 Navigation Buttons

From the Scenario Comparison screen, the user has three options using the buttons displayed at the top of the page:

- Close Scenario Comparison
- Clear Selected Scenarios
- Generate Allocation Chart

Close Scenario Comparison

Return to the Results screen.

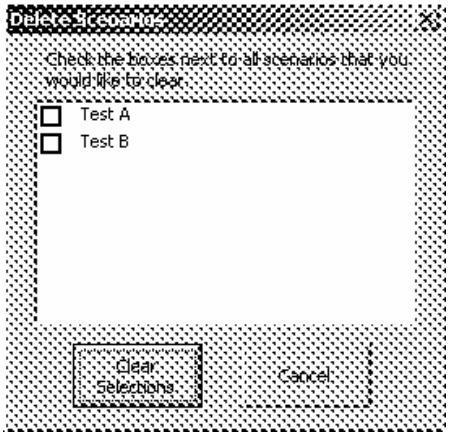
Clear Selected Scenarios

Delete one or more scenarios. The Delete Scenarios screen (Exhibit 7-4) will appear. Check the box next to the scenario(s) you would like to delete and click Clear Selections.

Generate Allocation Chart

Generate allocation and CPG Priority-Potential Effectiveness Index charts based on the saved scenarios. See **Section 7.3.4** for more information.

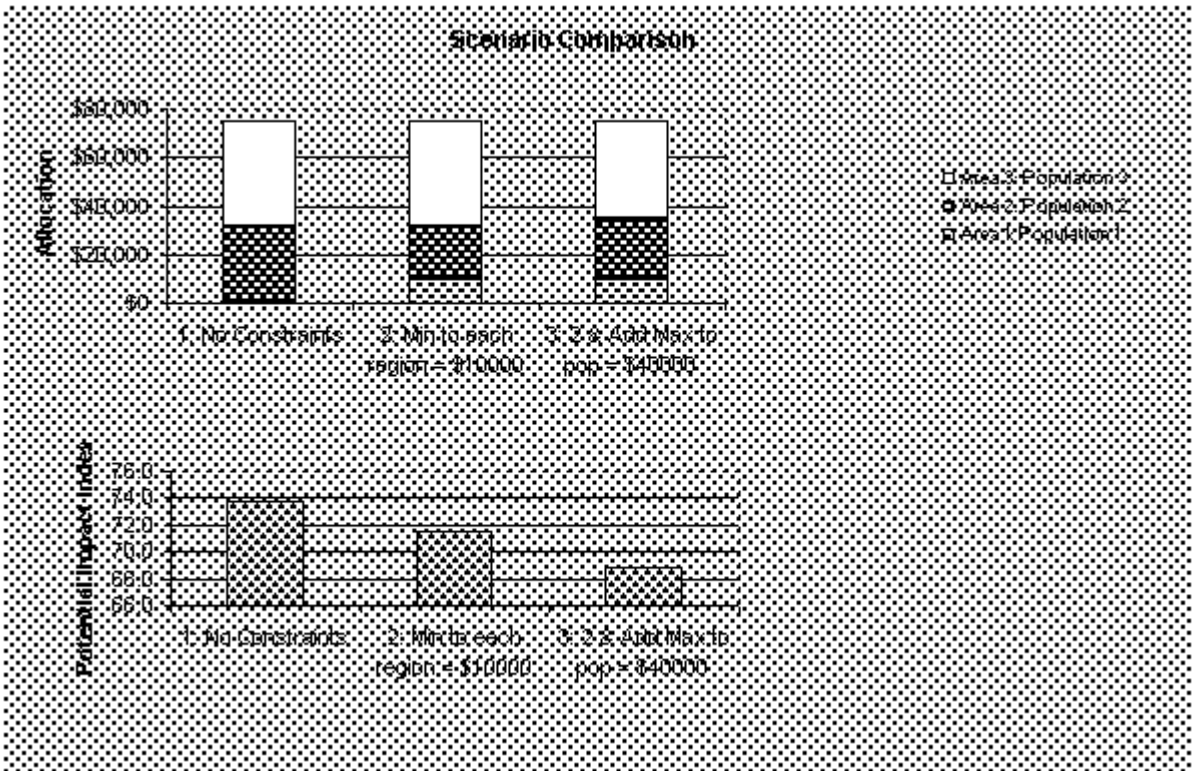
Exhibit 7-4. Delete Scenarios Screen



7.3.4 Scenario Comparison Bar Chart

To create a scenario comparison bar chart, click Generate allocation chart from the Results screen. The Scenario Comparison Bar Chart screen appears (Exhibit 7-5).

Exhibit 7-5. Scenario Comparison Bar Chart Screen



Two charts are presented, Allocation and Potential Impact Index, with a key to the right of the charts. Both charts present scenarios from left to right in order of highest to lowest Index values. For example, in Exhibit 7-5, the scenario “Test A” has a higher Index than the scenario “Test B.”

In the Allocation bar chart, each bar represents the model’s allocation of available funding across populations for a scenario. Each colored section within a vertical bar represents the amount of funding allocated to a specific population. A section’s corresponding population can be identified either by referring to the key to the right of the Allocation chart or by moving the mouse pointer across the section, which causes a comment box to appear with the population name and the amount of funding allocated.

In the Potential Impact bar chart, each bar represents a weighted measure of the potential number of infections averted, given the allocation of funds shown in the Allocation bar chart. As depicted in Exhibit 7-5, an improvement in the equity of the allocation often corresponds to a reduction in the potential impact of preventive efforts. In other words, the trade-off of improving the equity of the allocation by establishing constraints on the allocation of prevention funds is the loss in the weighted number of potential infections averted. The key value of using a tool such as the HPFAM is that a user may explore the extent of these trade-offs.

To exit the bar chart screen, click on any of the worksheet tabs located at the bottom of the window. The screen will automatically disappear.

8. Frequently Asked Questions and Troubleshooting

8.1 Frequently Asked Questions: Running the Model and Interpreting Model Results

What if I want to leave out or not fund certain populations/regions in one of the model runs without deleting them?

Set the maximum amount/percent of funding to the population/region to zero. If you delete a population or region from a model run, you will have to reenter it completely to include it again. As well, you will not be able to compare the results with previously saved scenarios. Note that this approach could be useful if you wanted to allocate funds for a specific activity, such as counseling and testing, but only wanted to allocate those funds to a handful of the regions in the jurisdiction.

What if I want to see how my jurisdiction's current or past allocations compare to the model's allocation(s)?

Set the minimum and maximum amount of funding for each population/region to the exact dollar amount of the current or past allocation to which you'd like to compare. The model will then be forced to allocate funding in exactly the same way as you did and will calculate its estimate of the Index associated with that allocation.

What if I want to change a population or region name?

The population or region name cannot be changed under the Edit Priority Population/Geographic Region screen (see Sections 5.2 and 6.2 for editing population- and region-specific information). To change a population or region name, the population/region must be deleted and then added again under the new name.

What if I want to change population- or region-specific information, other than the name?

Select View or Edit Geographic Region/Priority Population Information from the Switchboard. Then select Edit information for a region/population already entered in the database. Select the region/population that you want to edit from the pull-down list. After completing the changes, click Save. Be aware that after making such a change, you will no longer be able to compare results with previously saved scenarios.

What if I want to add an equity constraint after running the model?

From the Switchboard, click Set Options for Model Formulation. Select the appropriate tab (Equity Between Populations or Equity Between Regions) and check the constraint to be added. The default value for that constraint will automatically be set for all regions or populations (see Exhibits 4-4 and 4-6 for default values). In

order to change the region- or population-specific values from default, you will have to use the Edit Priority Population/Geographic Region screens. Note that adding or removing a constraint will not affect which populations are involved in a scenario; therefore, new runs can still be added to the Scenario Comparison screen with no problem.

What if I want to compare the effects of applying different constraints to the allocation?

To compare the impact of applying different constraints, begin by running the model with all of the constraints you want to consider, then re-run model scenarios with progressively less constraints. Remember to save the result of each run as a separate scenario. You can visually compare the saved scenarios by generating a Scenario Comparison bar chart (see **Section 7.3 Saving Results** for more information).

Note that unchecking constraints will cause you to lose the associated population- or region-specific values stored in the model. For example, if you originally selected "Allocate at least a percent of available funds to each selected population," unchecking this constraint will clear percentages entered for every population. One way to avoid losing this information is to save the file with all stored information and then, after you are finished with the comparison, close Excel without saving your changes.

What if I want to restrict some of the funds available for allocation to only be used with particular populations or for particular prevention activities (e.g., federal funds to be allocated cannot be used for needle exchange programs)?

You can accomplish this by restricting the amount of funds to be allocated to a population for which certain prevention activities could not be funded. Set the maximum amount of funds going to that population as the total amount of funds available for allocation minus the amount of restricted prevention funds.

What if I want to delete all of the populations in a region?

You can accomplish this in one of two ways:

1. Delete the region. This action will automatically delete every population in the region (see **Section 5.3** for more on deleting regions).

2. Delete each population individually. This will not automatically delete the associated region. But the model will not consider the region in the allocation (see **Section 6.3** for more on deleting populations).

Note that once you delete a population, you will not be able to compare future model runs with previously saved scenarios.

8.2 Troubleshooting

The model's allocation does not seem reasonable to me. Some of my priority populations received fewer funds than I would have expected and others received more. Why did this happen?

The first thing to keep in mind when a model allocation does not seem reasonable is that the HPFAM is essentially just a calculator. There may be information about the priority populations or geographic regions that you know but that the model did not or could not consider in its allocation.

Start by reviewing the Sensitivity Analysis to see which constraints are impacting the model's allocation. The Sensitivity Analysis can show you which constraint has an impact on the allocation and how they rank in degree of impact. Changing these constraints that impact the allocation by even a small amount will change the results. (For more information on the Sensitivity Analysis, see Section 7.2.)

Next, there are several population-specific parameters you should consider reviewing that also impact the final allocation. Exhibit 8-1 summarizes key population-specific parameters and their direction of impact on the model allocation. We expand on a few of these parameters below.

Exhibit 8-1. Impact of Changing Population-Specific Parameter Values on the Allocation to the Population

Parameter	Increasing the parameter value by a small amount …	
	… increases the allocation to the population	… decreases the allocation to the population
Population weight	X	
Number of people in population	X	
Percent of population living with HIV/AIDS	X (up to a point)	
Frequency of protection use		X
Number of partners per year	X	
Number of exchanges per partner per year	X	
Cost of intervention		X
Risk behavior = IDU (vs. sexual behavior)	X	
Risk behavior = sexual behavior (vs. IDU)		X

Population weight
Populations with higher weights will be considered more favorably in the allocation.

Number of people in population
The maximum the model will allocate to a population, regardless of any equity constraints entered, is the amount that funds 100 percent of the population to receive one intervention (or one package of interventions if the cost estimate entered represents the cost for a package of interventions as opposed to a single intervention). For example, if a population has 100 people and the cost of one prevention intervention for that population is $150, the maximum amount of funding the model will allocate to that population is 100 x 150 or $15,000.

If one of your populations received fewer funds than you would have expected, review the method used to calculate the number of people in the population. For example, in estimating the number of Black MSMs, it may not be reasonable in your jurisdiction to assume that the racial distribution for the population also holds for the MSM population. You may believe that Blacks make up a higher percentage of the MSM population than they do in the general population. Adjusting for this difference will likely increase the number of people in the risk population and may change the model allocation.

Percent of population living with HIV/AIDS
Populations with higher percentages of the population living with HIV/AIDS will be considered more favorably in the allocation. However, if a majority of the population is already infected, prevention opportunities are limited. Further increases in the percentage of the population that is infected will reduce the amount of prevention funding allocated to the population. If the target population for intervention is HIV-infected individuals, users should redefine the target population to include both HIV-infected individuals and their potential partners to ensure that funds will be allocated to this important target group.

I got an error message that says "Invalid Character Entry." What does this mean?

Numeric fields do not accept all types of characters. Characters that are acceptable vary; however, none allow letters. Exhibit 8-2 describes which character types are allowed in each numeric field.

I got an error message titled "Infeasibilities Warning" that automatically changed one of my settings. What does this mean?

This means that, because of other settings that you stored, the model cannot run correctly with the value that you just entered, so it automatically replaced it with a value that would allow it to run correctly. See General Guideline #8 (Section 3.1) for a more extensive explanation.

Exhibit 8-2. Character Types Allowed in Numeric Fields

Screen	Fields	Integers (e.g., 0,1,2)	Decimal Points for Fractional Values (e.g., 0.9, 10.75)
Options	All parameter assumptions	X	X
	Funding amounts	X	
Add/edit population information	Population weight	X	X
	Number in population	X	
	Percent of population living with HIV/AIDS	X	X
	Transmission risk behaviors	X	X
	Intervention cost	X	
	Equity constraints—%	X	X
	Equity constraints—$	X	
Add/edit geographic region information	Equity constraints—%	X	X
	Equity constraints—$	X	

I have a comment on my Results screen that says not all of my available funding could be spent. What does this mean?

This is a warning that the total amount of funding allocated to populations does not equal the total amount of funding available for allocation due to equity constraints that restrict the amount of funding to populations and regions. If you would rather the model allocate all available funding, you should edit the relevant constraint(s) to allow more money to be allocated to your regions and populations.

I just tried to save the model results and got the following warning: "The regions and populations included in the scenarios already included in the comparison are different than those included in this scenario. The comparison can only include one set of regions and populations. Do you want to replace the old set with the new one (and therefore delete all previous scenarios)?"

In order to store and compare different scenarios' results, those scenarios must include the same regions and populations. If the scenario to be saved does not include the same regions and/or populations as previously saved on the Scenario Comparison screen, the Region/Population mismatch screen will appear. Click Yes to replace previously saved sets of regions/populations with the current scenario's set. This will delete all previous scenarios. Click No to return to the Results screen.

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Appendix A:

Linear Programming and HPFAM Formulation

A.1 Linear Programming

The HPFAM uses a method for solving optimization problems called *linear programming* to determine the allocation of funding that maximizes the CPG Priority–Potential Effectiveness Index. This section is a brief primer on linear programming; it presents a basic definition of linear programming and the structure of a linear programming model (LP) and explains how to interpret the model solution and sensitivity analysis results.

A.1.1 LPs Defined

LPs involve the calculation of an allocation of scarce resources that optimizes some measure of performance given one or more constraints.

A.1.2 LP Structure

To perform the necessary calculations, an LP must include several basic components: decision variables, an objective function, and constraints.

- *Decision variables* represent the allocation decision that the LP varies to reach an optimal solution. In the HPFAM, the decision variables are the dollar amounts to go to each priority population eligible to receive HIV prevention funding in a jurisdiction. One decision variable represents the amount of funding to be allocated to one population.

- The *objective function* is a linear function that describes the value we wish to optimize (i.e., maximize or minimize) in terms of the decision variables. In the HPFAM, the objective function represents the weighted number of potential infections averted (weights represent the CPG priorities for prevention) given the amount of funding allocated to each population. The potential number of infections averted is the number of infections that would be expected to occur in the absence of intervention (and given no change in behaviors) and therefore is the maximum number of interventions that could be averted in a population given the implementation of effective prevention interventions. The model refers to the weighted number of potential infections averted as the Potential Impact Index.

- *Constraints* are limits on the values of the decision variables (i.e., the resource allocation) based on any factors that affect the allocation. These constraints often involve resource availabilities, policy restrictions, and others. Constraints in the HPFAM specify how much funding is available to allocate, ensure that populations and regions get equitable funding, and limit the percentage of each population funded to receive interventions to no more than 100 percent (which may seem obvious to us, but computers need to be told things like that!). When relevant (which is most of the time), LPs also include *nonnegativity constraints* that require that the decision variables only take nonnegative values.

  Constraints are normally set up as inequalities (versus equalities). In general, the left-hand side of the inequality is some function of the decision variables, or resources. The coefficient in front of each decision variable on the left-hand side

indicates the number of units of the associated scarce resource that is used up in a given process. The right-hand side represents the amount of the resource that is available for that process.

A.1.3 Solving an LP

Methods for solving LPs are well established but are almost exclusively implemented by computers. The HPFAM is Excel-based and uses its Solver add-in to perform the model optimization.

Only some sets of values of the decision variables will simultaneously satisfy all of the constraints imposed on the model. Those sets of values are called *feasible*. If no such sets of values exist, we say that the LP is *infeasible* (see General Guideline #8) and no solution will be computed.

Among the set of *feasible* values of the decision variables, some set optimizes the value of the objective function. That set of values is called the *optimal solution* of the LP.

A.1.4 Interpreting the LP Solution

The optimal solution ("the solution") of the LP represents the feasible set of values that optimizes the value of the objective function, given the constraints imposed. In the HPFAM, the solution is an allocation of HIV prevention funding among populations that maximizes the Potential Impact Index.

A.1.5 Interpreting Sensitivity Analysis Results

Not all constraints involved in the model end up having an impact on the optimal allocation. Say, for example, in the HPFAM, that the minimum funding amount for a region is set to $10,000 and the model's final allocation to that region is $15,000. Since $15,000 is greater than $10,000, we know that that constraint *does not* have an impact on the allocation. If it *did* have an impact on the allocation, then the region would get exactly the minimum amount specified, $10,000. If constraints that *do not* have an impact on the allocation are changed by a little bit (for example, $10,000 is increased to $10,100), the allocation will not change. If, on the other hand, constraints that *do* have an impact on the allocation are changed by a small amount, then the entire allocation will change.

In turn, among those constraints that *do* have an impact on the allocation, some have more of an impact than others. What this means is that a $1 change to the amount associated with one constraint will increase or decrease the Index by more than would a $1 change to the dollar amount associated with another constraint.

A.2 HPFAM Formulation

Variables

Decision Variable

x_{ij} = Funding to allocate to population *j* in geographic region *i*; *i* = 1 to *m*, *j* = 1 to *n*

Parameters

N_{ij} = number of individuals in population *i,j*

w_{ij} = weight associated with population *i,j* that quantifies CPG priority

p_{ij} = HIV prevalence in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

$v_{s,ij}$ = infectivity per infected sexual partner in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

$v_{n,ij}$ = infectivity per needle exchange with infected partner in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

t_{ij} = annual number of risk behavior partners in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

g_{ij} = annual number of risky exchanges per partner in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

o_{ij} = percent of risky exchanges in which protection (condoms/bleaching) is used in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

f_{ij} = effectiveness of protection relevant to risk behaviors by population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

l = partner overlap factor (same for all populations); percentage of an HIV-positive individual's sexual partners who are also sexual partners with other HIV-positive persons

C = amount of available funding (from CDC and other sources) to be allocated

c_{ij} = average per person annual cost to implement one intervention in population *i,j* (based on previous years' findings); *i* = 1 to *m*, *j* = 1 to *n*

s_{ij} = dollars specifically designated for interventions for population *i,j* ("designated funds"; exclusive of C); *i* = 1 to *m*, *j* = 1 to *n*

b_{ij} = (optional) minimum percentage of population *i,j* to be allocated funding; *j* = 1 to *n*

m_i = (optional) minimum percentage of available funding to be allocated to region *i*; *i* = 1 to *m*

a_i = (optional) maximum percentage of available funding to be allocated to region *i*; *i* = 1 to *m*

k_{ij} = (optional) minimum percentage of available funding to be allocated to population *i*, *j*; *i* = 1 to *m*, *j* = 1 to *n*

z_{ij} = (optional) maximum percentage of available funding to be allocated to population *i, j*; *i* = 1 to *m*, *j* = 1 to *n*

Calculated Variables

e^{p}_{ij} = expected number of new infections "received" per year by each uninfected person in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

= (expected number of new infections "received" per year by each uninfected person in population *i,j* from sexual activity, based on per partner infectivity) + (expected number of new infections "received" per year by each uninfected person in population *i,j* from needle exchange, based on per exchange infectivity); *i* = 1 to *m*, *j* = 1 to *n*

= $\{1 - [1 - \text{Prev} * \text{Per Partner Infectivity} * (1 - \text{ProtFreq} * \text{ProtEff})]^{\text{NumPartners}}\} +$
$(1 - \{1\text{-Prev} * [1 - (1 - \text{Per Needle Exchange Infectivity})^{\text{NumUnsafeExchgPerPartner}} *$
$(1 - \text{Inf'yWithProtection})^{\text{NumSafeExchgPerPartner}}]\}^{\text{NumPartners}})$

= $\{1 - [1 - p_{ij} * v_{s,ij} * (1 - o_{ij} * f_{ij})]^{tij}\} +$
$(1 - \{1 - p_{ij} * [1 - (1 - v_{n,ij})^{gij*(1-oij)}] * [1 - v_{ij}*(1 - f_{ij})]^{gij*oij}\}^{tij})$

e^{s}_{ij} = expected number of infections "given" per year per infected person in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

= (expected number of infections "given" per year per infected person in population *i,j* by sexual activity) + (expected number of infections "given" per year per infected person in population *i,j* by needle exchange); *i* = 1 to *m*, *j* = 1 to *n*

= $\{[(1 - \text{PartnerOverlap}) * \text{NumPartners} * (1 - \text{Prev})] * [\text{Per Partner Infectivity} *$
$(1 - \text{ProtFreq} * \text{ProtEff})]\} + \{\text{NumPartners} * (1 - \text{Prev}) *$
$[1 - (1 - \text{Per Needle Exchange Infectivity})^{\text{NumUnsafeExchgPerPartner}} *$
$(1 - \text{Inf'yWithProtection})^{\text{NumSafeExchgPerPartner}}]\}$

= $\{[(1 - l) * t_{ij} * (1 - p_{ij})] * [v_{s,ij} * (1 - o_{ij} * f_{ij})]\} +$
$(t_{ij} * (1 - p_{ij}) * \{1 - (1 - v_{n,ij})^{gij*(1-oij)} * [1 - v_{n,ij}*(1-f_{ij})]^{gij*oij}\})$

M^{u}_{ij} = total number of uninfected individuals in population *i,j*; *j* = 1 to *n*, *i* = 1 to *m*

= $N_{ij}*(1-p_{ij})$

M^{i}_{ij} = total number of infected individuals in population *i,j*; *j* = 1 to *n*, *i* = 1 to *m*

= $N_{ij}*p_{ij}$

n_{ij} = number of individuals in population *i,j* funded (using all types of dollars) to receive interventions; *j* = 1 to *n*, i = 1 to *m*

$$= \frac{\mathbf{s_{ij}} + \mathbf{x_{ij}}}{\mathbf{c_{ij}}}$$

e_{ij} = total annual number of expected potential infections per person in population *i,j*; *i* = 1 to *m*, *j* = 1 to *n*

$$= \frac{\mathbf{e^{p}_{ij}} \cdot \mathbf{M^{u}_{ij}} + \mathbf{e^{s}_{ij}} \cdot \mathbf{M^{i}_{ij}}}{\mathbf{M^{u}_{ij}} + \mathbf{M^{i}_{ij}}}$$

Formulation

Objective function: maximize the number of expected potential infections averted, weighted by population based on CPG priority

$$\text{Max} \sum_i \sum_j \mathbf{w_{ij} e_{ij} n_{ij}}$$

- *Adjusted for sensitivity analysis*, we can obtain a range on $\frac{\mathbf{w_{ij} e_{ij}}}{\mathbf{c_{ij}}}$.

$$\text{Max} \sum_j \sum_i \mathbf{w_{ij} e_{ij}} \frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}} + \sum_j \sum_i \mathbf{w_{ij} e_{ij}} \frac{\mathbf{x_{ij}}}{\mathbf{c_{ij}}}$$

The CPGs may rank or weight the different populations being considered for prevention resources. The user may enter population weights in the model that capture these rankings.

Constraints

1. The funds allocated must not exceed the amount of available funds.

$$\sum_i \sum_j \mathbf{x_{ij}} \leq \mathbf{C}$$

Note: This constraint exists when we have an upper limit on C. If there is no upper limit or if the decision makers are submitting proposals for the ideal amount of funds needed, then C is set to an arbitrarily large number or the constraint is dropped from the model.

- No adjustments need to be made for sensitivity analysis. We obtain a range on C.

2. Allocate funds so that interventions are implemented with no more than 100 percent of the population.

$$\mathbf{n_{ij}} \leq \mathbf{aN_{ij}} \quad \forall \mathbf{i, j}$$

- *Adjusted for sensitivity analysis*, we can obtain a range on $\mathbf{aN_{ij}} - \frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}}$ in which we can assume $\mathbf{aN_{ij}}$ or $\frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}}$ at a fixed value.

$$\frac{\mathbf{x_{ij}}}{\mathbf{c_{ij}}} \leq \mathbf{aN_{ij}} - \frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}} \quad \forall \mathbf{i, j}$$

3. (Optional) Allocate funds so that interventions are implemented with at least a prespecified percentage of each population.

$$\mathbf{n_{ij}} \geq \mathbf{b_{ij}N_{ij}} \quad \forall \mathbf{i, j}$$

- *Adjusted for sensitivity analysis*, we can obtain a range on $\mathbf{b_{ij}N_{ij}} - \frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}}$ in which we can assume $\mathbf{b_{ij}N_{ij}}$ or $\frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}}$ at a fixed value.

$$\frac{\mathbf{x_{ij}}}{\mathbf{c_{ij}}} \geq \mathbf{b_{ij}N_{ij}} - \frac{\mathbf{s_{ij}}}{\mathbf{c_{ij}}} \quad \forall \mathbf{i, j}$$

4. (Optional) Allocate at least a prespecified percentage of available funds to each geographic region.

$$\sum_{\mathbf{j}} \mathbf{x_{ij}} \geq \mathbf{m_i C} \quad \forall \mathbf{i}$$

- No adjustments need to be made for sensitivity analysis. We obtain a range on $(\mathbf{m_i})(\mathbf{C})$.

4. (Optional) Allocate no more than a prespecified percentage of available funds to each geographic region.

$$\sum_{\mathbf{j}} \mathbf{x_{ij}} \leq \mathbf{a_i C} \quad \forall \mathbf{i}$$

- No adjustments need to be made for sensitivity analysis. We obtain a range on $(\mathbf{a_i})(\mathbf{C})$.

5. (Optional) Allocate at least a prespecified percent of available funds to each population.

$$\mathbf{x_{ij}} \geq \mathbf{k_{ij} C} \quad \forall \mathbf{i, j}$$

- No adjustments need to be made for sensitivity analysis. We obtain a range on $(\mathbf{k_{ij}})(\mathbf{C})$.

6. (Optional) Allocate no more than a prespecified percent of available funds to each population.

$$\mathbf{x_{ij}} \leq \mathbf{z_{ij} C} \quad \forall \mathbf{i, j}$$

- No adjustments need to be made for sensitivity analysis. We obtain a range on $(\mathbf{z_{ij}})(\mathbf{C})$.

Appendix B:

Estimating Parameter Values and Jurisdiction-Specific Data

In this appendix, we provide both general guidelines and default values from the literature for inputting jurisdiction-specific data and estimating parameter values required by the HPFAM.

Users should remember that the guidelines and values described below serve only as suggestions—it is not necessary to follow the methodologies presented in this appendix for the HPFAM to run. Instead, we expect the methods described below to be a starting point for decision makers in comparing the impact of different allocations on potential effectiveness.

B.1 General Parameters

In this section, we provide default values obtained from the literature for estimating general parameters. All of the parameters described below are entered into the model by clicking 1. Set Options for Model Formulation from the Switchboard and then selecting the Parameter Assumptions tab (see **Section 4.5)**. Exhibit B-1 summarizes each parameter, its source, and the default value.

Exhibit B-1. General Parameters

Parameter	What to Enter	Source	Default Value
Dirty needle infectivity	The average probability of HIV transmission from a previously used needle per contact	Kaplan and Heimer, 1992	0.01
Effectiveness of bleaching	The probability that a syringe is disinfected (HIV is removed) after rinsing with diluted bleach	Abdala et al., 2001 Normand et al., 1995	0.67
Per-infected partner infectivity	The probability of HIV transmission from sexual intercourse (vaginal and anal) with an infected partner	Anderson and May, 1998	0.1
Effectiveness of condoms	The probability that HIV transmission is prevented by using a condom during sexual intercourse (vaginal or anal)	Pinkerton and Abramson, 1997 Silverman and Gross, 1997	0.935
Partnership overlap factor	The percent of an HIV-positive individual's sexual partners who are also sexual partners with other HIV-positive persons	Pinkerton, Holtgrave, and Valdiserri, 1997	0.25

B.1.1 Dirty Needle Infectivity

- This cell represents the average probability of HIV transmission from a previously used needle per contact.

- Kaplan and Heimer (1992) reported the mean infectivity for transmission through needle sharing to be **0.01** per contact.

- This estimate accounts for different infectivity rates with disease progression. For example, during the first 6 to 8 weeks after initial HIV transmission or newly infected individuals, infectivity rates are estimated to be between 0.1 and 0.3 per contact. But this probability drops during early, asymptomatic stages of the disease to 0.0001 to 0.001 per contact (Kaplan and Heimer, 1992).

B.1.2 Effectiveness of Bleaching

- This cell represents the probability that a syringe is disinfected (HIV is removed) after rinsing with diluted bleach.

- Abdala et al. (2001) reported the effectiveness of bleaching a syringe with diluted bleach to be **0.67**.

- The probability associated with rinsing a syringe with diluted bleach instead of undiluted bleach (the CDC recommends rinsing a previously used syringe with undiluted bleach to prevent HIV transmission through needle sharing) is used to account for imprecise and variable bleaching techniques by the intravenous drug user (Normand et al., 1995, p. 188).

B.1.3 Per-Infected Partner Infectivity

- This cell represents the probability of HIV transmission from sexual intercourse (vaginal and anal) with an infected partner.

- Anderson and May (1998) reported the per-infected partner infectivity to be **0.1** across both heterosexual and homosexual relationships.

- This estimate accounts for the lower probability of transmission in heterosexual partnerships than in homosexual partnerships. But heterosexual partnerships tend to last longer and have more contacts, compensating for higher transmission probabilities in homosexual relationships (Anderson and May, 1998).

B.1.4 Effectiveness of Condoms

- This cell represents the probability that HIV transmission is prevented by using a condom during sexual intercourse (vaginal or anal).

- We assumed that the average effectiveness of condoms including vaginal and anal intercourse is **93.5 percent**. Pinkerton and Abramson reported condom effectiveness for vaginal sex to be 95 percent (1997). Silverman and Gross reported condom effectiveness for anal sex to be 92 percent (1997).

B.1.5 Partnership Overlap Factor

- This cell represents the percentage of an HIV-positive individual's sexual partners who are also sexual partners with other HIV-positive persons. This factor only applies to populations with sexual risk behaviors.

- Pinkerton, Holtgrave, and Valdiserri (1997) reported the partnership overlap factor to be **25 percent.**

B.2 Population-Specific Data

In this section, we provide methodologies and U.S. national average values obtained from the literature and publicly available data for estimating population-specific inputs. All of the parameters described below are entered into the model by clicking 3. View or Edit Priority Population Information from the Switchboard (see **Section 6**). Although it is important that users enter values that are specific to their populations, some values have already been entered into the model and will be used as default values for calculations if not changed by the user.

Exhibit B-2 describes each population-specific parameter, possible sources, and where available, a value based on national averages from the current literature. The sources listed in Exhibit B-2 are possible starting points for identifying data that are specific to your local community and the HIV prevention needs in your community. Estimated national values are used for model calculations if values are not revised by the user to reflect local circumstances.

B.2.1 Population Weight

- This cell represents a factor (0–1) for weighting populations by priority. Populations with higher weights will be considered more favorably in the allocation.

- Populations can be assumed to have equal priority by setting all of the weights to the same number (for example, all equal to 1). The weights need not sum to 1 across populations or regions.

B.2.2 Number of People in the Population

- This cell represents the total number of people in the priority population. Populations may be defined according to risk behaviors, demographic characteristics, or any other way that CPGs have defined priority populations.

- The methodology for estimating this parameter value may vary by risk group. Sample calculations are presented below. Other jurisdictions may use different approaches in their process of generating estimates for community planning and preparing a comprehensive plan.

Exhibit B-2. Jurisdiction-Specific Data

Parameter	What to Enter	Possible Sources	Estimated National Value
Population Weight	A factor (0–1) for weighting populations by priority	Value from CPG/User defined	Varies
Number of people in the population	The total number of people in the priority population	Comprehensive Plan or Epi Profile U.S. Census Bureau, 2003a Florida Dept. of Law Enforcement, 2000 HIV/AIDS surveillance data (CDC) Literature	Varies
Percent of population living with HIV/AIDS	The number of people living with HIV/AIDS divided by the total number of individuals within the priority population	HIV/AIDS surveillance data (CDC) Epi Profile data Community Assessments	Varies
Frequency of protection use	The percentage of individuals that used protection at the last sexual intercourse (condoms) and/or intravenous drug use (needle bleaching)	Literature, Office of Applied Studies, SAMHSA, 2003	MSM = 0.34 Het. = 0.358 IDU = 0.32
Number of partners per year	The average number of different people an individual has sex with and/or exchanges needles with per year	Laumann et al., 1994 Kahn, 1998	MSM = 3.1 Het. = 3 IDU = 3.5
Number of exchanges per partner per year	The average number of needle exchanges by a person in the IDU priority population per partner per year	Holtgrave et al., 1998 Kahn, 1998	248
Annual per person cost to conduct one prevention intervention	The cost per person to carry out a single prevention intervention. The default value is an average across all interventions for the population for which cost data have been published	MSMs: Bedimo et al., in press Holtgrave and Kelly, 1997 Kahn et al., 2001 Pinkerton, Holtgrave, and Valdiserri, 1997 Pinkerton et al., 1998 Tao and Remafedi, 1998 Heterosexuals: Bedimo et al., in press Chesson, Greenberg, and Hennessy, 2002 Holtgrave and Kelly, 1996 Pinkerton, Holtgrave, and Jemmott, 2000 IDUs: Kahn et al., 1992 Pinkerton et al., 2000	MSM = 191 Het. = 101 IDU = 146 MSM/IDU = 253

– Intravenous Drug Users (IDU)

To estimate the IDU population per jurisdiction, we might begin with an estimate of the total number of active IDUs across a jurisdiction. For example, the Florida Department of Health, Bureau for HIV/AIDS estimated that there are about 104,000 active IDUs in Florida. Next, we compare this estimate to the total number of drug/narcotics arrests reported in the same jurisdiction to estimate the percentage of drug/narcotics arrests that represent active IDUs. This ratio is then multiplied by the number of drug/narcotics arrests by sex and by the estimated racial distribution of IDUs as reported by Pinkerton, Holtgrave, and Jemmott (2000).

This racial distribution was derived from the National AIDS Demonstration Research (NADR) Program, a study initiated in 1987 by the National Institute on Drug Abuse (NIDA) to assess the impact of AIDS prevention strategies with injecting drug users and their sexual partners. Overall, the NADR sample was 51 percent African-American, 25 percent Hispanic, and 22 percent White.

For example, the number of White female IDUs is estimated using the following formula:

$$\text{No. of white female IDUs} = \text{No. of female drug/narcotics arrests} \times \text{\% of IDUs that are white} \times \frac{\text{No. of active IDUs in state}}{\text{Annual no. of drug/narcotics arrests in state}}$$

– Men who have sex with men (MSM)

Several methods are available to estimate the MSM population, including the unmarried partner method based on Census data and the never married method based on Current Population Survey data (Black et al., 2000).

We present the unmarried partner method because it allows for regional differences across the jurisdiction and therefore can partially account for the tendency of the MSM population to cluster. The first step involves determining the number of unmarried partner households as reported in the 2000 Census of Population and Housing (U.S. Census, 2003a). Next, we determine the percentage of these households reporting same-sex male for both the householder and the unmarried partner using the 1-percent Public Use Microdata Sample available online at www.census.gov (U.S. Census, 2003b). We assume that these households represent coupled MSMs.

However, because studies have shown that MSMs couple at a rate of 28.4 percent, we assume that unmarried partner households (including the householder and unmarried partner) account for only 28.4 percent of the total MSM population in the jurisdiction (Black et al., 2000). Finally, we assume that the population racial distribution holds for the MSM population.

For example, the number of Black MSMs is estimated using the following formula:

$$\text{No. of black MSMs} = \text{No. of unmarried partners} \times \text{\% of unmarried partner households with 2 adult males} \times \frac{\text{\% of population that is black}}{\text{Annual no. of drug/narcotics arrests in state}} \times \frac{1}{0.284}$$

– Heterosexuals

To estimate the heterosexual population, we begin by assuming the heterosexual population is the fraction of the total population that is not homosexual. We determine this fraction by dividing the number of MSMs (adjusted for the coupling rate and without regard to race) by the total male population in the jurisdiction. We then assume that the same percentage of the female population is homosexual. Therefore, the percentage of the population that is heterosexual is estimated using the following formula:

$$\text{\% of population that is heterosexual} = 1 - 2 \times \text{\% of population that is male and homosexual}$$

Next, this percentage is multiplied by total population, racial distribution, and gender distribution for the jurisdiction. Finally, we assume that a fraction of the total heterosexual population is at high risk for HIV. One national-level estimate for this fraction can be obtained from the National Health Interview Survey, AIDS Knowledge and Attitudes Supplement. In 1995, 3.17 percent of participants reported either engaging in a risk behavior associated with HIV (e.g., diagnosed with hemophilia, intravenous drug use, anal intercourse, trading sex for drugs or money) or having sexual intercourse with an at-risk individual during the past year.

For example, the number of at-risk Hispanic heterosexual females is estimated using the following formula:

$$\text{No. of Hispanic Het. Females} = \text{Total Population} \times \text{\% of pop. heterosexual} \times \text{\% of pop. female} \times \text{\% of pop Hispanic} \times 0.0317$$

– Men who have Sex with Men and inject drugs (MSM/IDU)

To estimate the MSM/IDU population, we begin with the estimated number of male IDUs for each jurisdiction, as described above. Next, we multiply by the racial distribution of IDUs assumed to hold for all counties as reported by Normand, Vlahov, and Moses (1995). Finally, we assume that the number of MSMs divided by the total male population in the jurisdiction is the percent of the population that is homosexual.

For example, the number of Black MSM/IDUs is estimated using the following formula:

$$\text{No. of black MSM/IDUs} = \text{No. of male IDUs} \times \text{\% of IDUs that are black} \times \text{\% of population that is homosexual}$$

B.2.3 Percent of Population Living with HIV/AIDS

- This cell represents the number of people living with HIV/AIDS within a priority population divided by the total number of individuals within the priority population. It is entered into the cell as a percentage with a range of 0 to 100.

- For example, a prevalence of 3 for the priority population named Black heterosexual females would imply that 3 percent of all Black heterosexual females in the corresponding geographic region are living with HIV/AIDS.

- The number of people living with HIV/AIDS by race, gender, and mode of exposure for each jurisdiction (the numerator) can be obtained from surveillance data from the CDC and may be supplemented with survey data to estimate both diagnosed and undiagnosed infections in a population.

- The calculation of the number of individuals within the priority population (the denominator) is described above under “Number of people in the population.”

B.2.4 Frequency of Protection Use

- This cell represents the percentage of individuals within a priority population that used protection at the last sexual intercourse (condoms) and/or intravenous drug use (needle bleaching). As is the case for all of these population-specific input variables, users should enter values that are specific to their local populations whenever possible.

- Anderson (2003) reported **34 percent** of MSMs used a condom at last sexual intercourse, while **35.8 percent** of heterosexuals at high risk for HIV used a condom at last sexual intercourse.

- Based on data reported from the National Household Survey on Drug Abuse, **32 percent** of IDUs used bleach to prevent HIV transmission before receiving bleach distribution and education (Office of Applied Studies, SAMHSA, 2003).

B.2.5 Number of Partners per Year

- This cell represents the average number of different people an individual within the priority population has sex with and/or exchanges needles with per year. Users should enter values that are specific to their local populations whenever possible.

- Kamb et al. (1998) reported that, in a given year, heterosexuals average **3** sex partners, while Laumann et al. (1994) reported that MSMs average **3.1** sex partners. Kahn (1998) reported that IDUs average **3.5** needle-sharing partners.

B.2.6 Number of Exchanges per Partner per Year

- This cell represents the average number of needle exchanges by a person in the IDU priority population per partner per year. Users should enter values that are specific to their local populations whenever possible.

- We assumed that the number of exchanges per partner per year is **248**. This estimate is derived by dividing 868—the number of injections with an unsterile syringe per IDU per year as reported by Holtgrave et al. (1998)—by 3.5—the estimated number of needle-sharing partners per IDU per year as reported by Kahn (1998).

B.2.7 Annual per Person Cost to Conduct Prevention Interventions

- This cell represents the cost per person to carry out a single prevention intervention or, if more relevant for the way interventions are funded in an area, for a package of interventions. This value is the expected cost of intervening with the population and should ideally be based on data collected from local providers. Where no local data are available, cost estimates may be based on data from the published literature.

- Intervention cost estimates include the direct costs of implementation, such as staff salaries, educational materials, rent/utilities, and the value of volunteer time. The cost estimates do not represent total societal costs because they do not include client transportation, discounted medical costs associated with HIV/AIDS, or monetary compensation to the client.

- To estimate national values for intervention costs for selected risk-based populations, we obtained cost estimates from the literature on several types of prevention interventions for each risk population. The cost estimates were then adjusted to 2000 U.S. dollars and averaged.

- For MSM/IDU priority populations, we added the average intervention cost for MSMs and IDUs. Then, we multiplied by 0.75.

B.2.8 Amount of Funding Specifically Designated for the Population Outside the Model

- This cell represents the amount of funding that has already been specifically designated for implementing prevention interventions with a certain priority population.

- This dollar amount is exclusive from the money that this model allocates. It is considered only in the calculation of the percent of the population that will receive interventions and does not factor into our calculations of the potential impact of the funds allocated by the model.